AN ECONOMIC EVALUATION OF CONFINEMENT

SWINE SYSTEMS IN OKLAHOMA

Thesis Approved:

Vernon R. Eidman
Thesis Adviser

Harry P. Mapp, Jr.

Ted R. Nelson

N. N. Durham
Dean of the Graduate College

PREFACE

This study is an analysis of alternative confinement swine systems for Oklahoma. Primarily the objective is to develop and present planning information that can be used by present and potential swine producers in Oklahoma. The basic types of systems to be evaluated are a farrow-to-finish operation, a feeder pig producing operation, and a finishing of feeder pig operation.

Appreciation is expressed to the Department of Agricultural Economics, Oklahoma State University, for making this study possible and for the financial aid received during my graduate study.

The author is deeply indebted to Dr. Vernon Eidman, chairman of my graduate committee, for his supervision, advise, cooperativeness, and patience during all phases of this thesis and my graduate program. A special thanks are due Dr. Ted Nelson and Dr. Harry Mapp for their invaluable assistance in the preparation of the final manuscript.

The author also wishes to thank Dr. Peter Bloome, Dr. William Luce, and Mr. Clint Roush for their extremely valuable input to this study. A special acknowledgement is made to Mrs. Marsha Collier for typing all the early drafts of this manuscript.

Finally, it must be stated that the author could not have completed this study had it not been for the understanding, encouragement and love he received from his wife, Terri, who endured many nights and week-ends alone for this study. Also, to my parents, thank you.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Gross income from the production of hogs in Oklahoma totaled 40.5 million dollars in 1972 and 44.9 million dollars in 1973. This is the largest contribution the hog industry has made to Oklahoma agricultural gross income since 1951. Relatively though, hogs rank eighth in value of production compared to all other agricultural products.[1]

The dramatic increase in the gross income from a low of 18 million dollars in 1964 to the high of 44.9 million in 1973 is directly attributed to two related factors, 1) an increase in the average annual price of hogs and 2) an increase in the number of hogs marketed.

The average price received for hogs was $14.80 per hundred pounds in 1964 as compared to $24.60 in 1972 and $37.50 in 1973. As shown in Figure 1, marketing numbers increased over the 1964-1972 time period, ranging from a low of less than 370,000 head marketed in 1965 to a high of over 700,000 in 1971. The calendar year 1973 had a reduction in marketings but had the highest average price received for hogs in the last 25 years.

---

[1] Oklahoma 1973 Agricultural Statistics, Oklahoma Crop and Livestock Reporting Service, (Oklahoma City, Oklahoma, September, 1974), pp. 75-105.

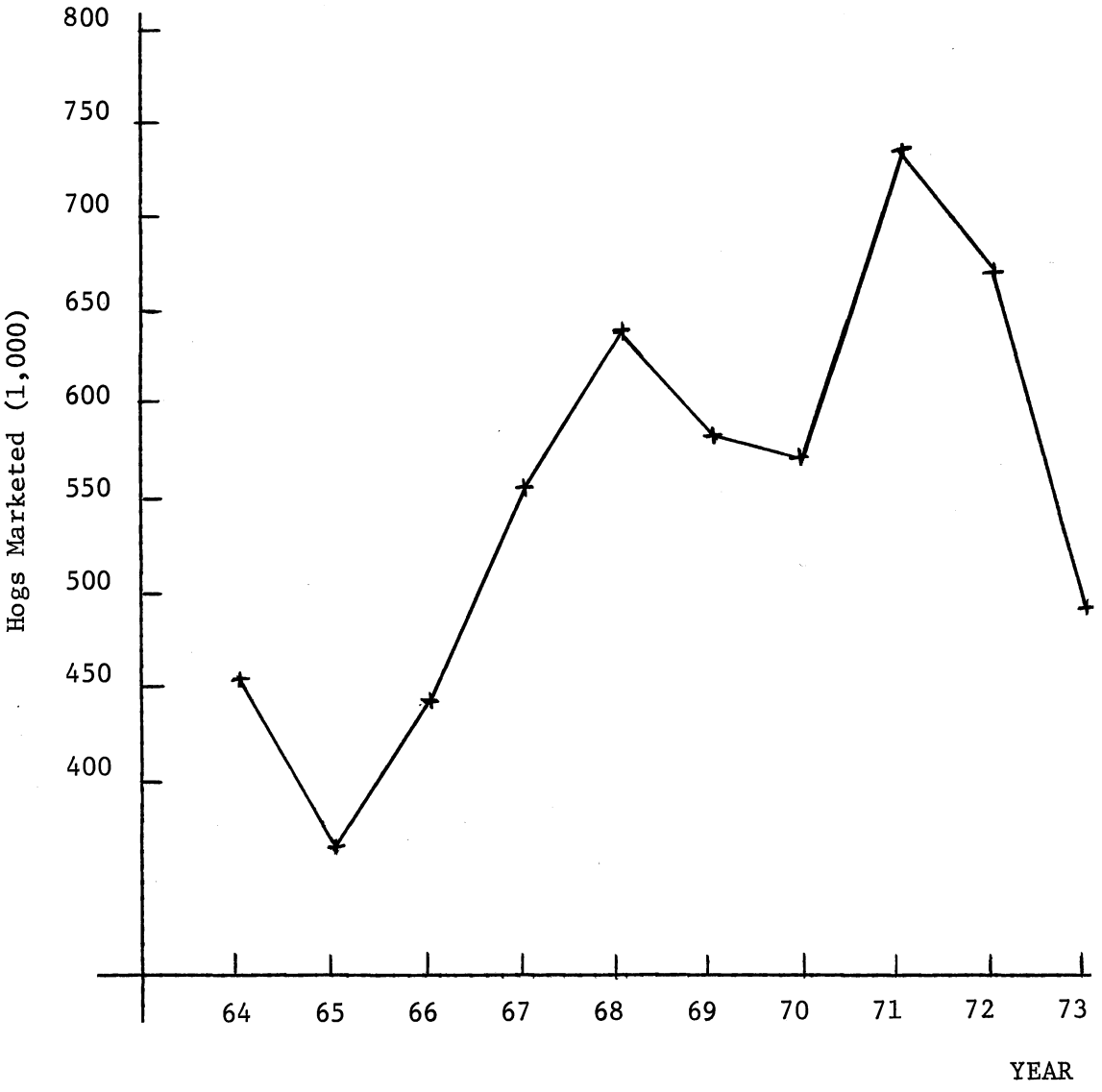

Figure 1. Hogs Marketed in Oklahoma[2]

[2]Ibid.

The Hog Enterprise in Oklahoma

While the output of the hog industry has trended upward during the last ten years, the number of farms producing hogs has been decreasing as shown in Table I. The number of hog farms has decreased from a high of 15,500 in 1966 to a low of approximately 9,000 in 1973 and 1974. As farm numbers have decreased, hog inventory numbers per farm for June, 1 of each year doubled from 1965 to 1971 and then remained comparatively stable as indicated in Table I.[3] Combining this information with the 1964 and 1969 Census data that shows an increase in hog farms which sell more than one hundred pigs per year from 885 in 1964 to almost 1,300 in 1969, adds evidence that the number of larger commercial swine farms is increasing in Oklahoma. This trend parallels what has happened to the swine industry nationwide over the last ten years. The hog enterprise has shifted from a pasture or semi-confinement system supplementary to the farmer's main enterprise to confinement systems with relatively constant labor, capital and management resource requirements throughout the year.

The Problem

The problem that arises, as there is an increase in confinement systems, is the lack of general economic planning information for present and potential hog enterpreneurs in Oklahoma. In particular, what are the alternative production systems to choose from and what is expected of each system in terms of costs and returns? Thus, there is a

---

[3] Ibid.

need to estimate and develop input-output coefficients for swine systems that the entrepreneur can compare with other production alternatives.

TABLE I

YEARLY HOG FARM NUMBERS AND YEARLY JUNE 1 HOG INVENTORY NUMBERS FOR OKLAHOMA[A/]

Year	Number of Farms	June 1 Inventory	Average Inventory Per Farm
1974	9,000	320,000	35.6
1973	9,000	330,000	36.7
1972	10,500	409,000	39.0
1971	13,000	521,000	40.1
1970	12,000	395,000	32.9
1969	13,000	338,000	26.0
1968	15,000	318,000	21.2
1967	15,000	353,000	23.5
1966	15,500	321,000	20.7
1965	14,000	255,000	18.2

[A/] Oklahoma 1973 Agricultural Statistics, by the Oklahoma Crop and Livestock Reporting Service.

Specific areas which lack planning information are investment costs, operating costs, and output yields. The entrepreneur needs information on what it costs to establish a hog enterprise, what it costs to operate

that system, what level of output the system produces and the projected cash flow so that the entrepreneur's resources are employed where they maximize returns to his management ability.

Objectives

The general objective of this study is to provide planning information for commercial hog producers in Oklahoma. This information results from an economic evaluation of costs and returns for large confinement swine systems. Since hogs are not of the economic importance of cattle and wheat in Oklahoma, little economic research has been done in this area. It is impossible to address all the factors that affect costs and returns in one study. Thus, it is necessary to approach the basic areas which show a lack of decision making information. Specifically the objectives are to:

1. Establish investment and operating costs and returns for three basic confinement swine systems.
   i. Farrow-to-Finish
   ii. Feeder Pig Production system
   iii. Finishing Feeder Pig system
2. Compare the farrow-to-finish operation as an integration of the feeder pig producing system with the finishing of feeder pig system.
3. Determine the profitability of vertically coordinating on-farm feed processing and on-farm grain storage with the basic systems as an alternative input combination.
4. Develop a projected monthly cash flow for various systems to determine the affect economic and managerial factors have on

the profitability of the systems.

There are many economic factors that affect the input-output relationship of a confinement swine system. The next chapter examines the underlying economic theory of the costs of production and develops the procedure the study uses to evaluate the input-output relationship of confinement swine systems in Oklahoma.

CHAPTER II

THEORETICAL CONCEPTS AND PROCEDURES

The purposes of this chapter are to (1) review the relevant economic theory with respect to the planning information gained from (a) economies of size relationships and (b) vertical coordination of various economic stages; and (2) develop the analytical procedure used in this thesis. Also considered is the relationship of the analysis and the planning information it is to provide to the swine enterpreneur.

Theory

Economic studies of swine production operations are of many types, but the common underlying element of such studies is the production function. The production function is the technical relationship between inputs and outputs. Inputs are the factors or resources that are combined to yield the output sold by the firm. As Stigler[1] points out, the production function is used to help provide decision making information from either one of two approaches; (1) maximize production from a given set of resources or (2) minimize cost of securing a given product. The latter is the approach used by most entrepreneurs, since it offers the most flexibility with respect to the number of inputs and output that can be considered.

---

[1]George J. Stigler, The Theory of Prices (New York, 1946), pp. 109-115.

Cost Function

When an economist estimates the minimum cost combination of inputs for an enterprise such as swine, it is necessary theoretically to derive the basic cost function from the production function. The total cost function is the "mirror image" of the production function including the value of the resources. For example, the power type of production function in equation 1,

$$(1) \qquad Y = cX_1^{b_1} X_2^{b_2} \ldots X_n^{b_n}$$

denotes that production of good, Y, is the combination of c times the product of the units of X_i to the b_ith power. Using a per unit price of resource X_i of P_{x_i} equation 2 is derived,

$$(2) \quad \text{Total Cost} = \sum_{i=1}^{n} P_{x_i} c^{-\frac{1}{b_i}} Y^{\frac{1}{b_i}} X_1^{-\frac{b_1}{b_i}} \ldots X_{i-1}^{-\frac{b_{i-1}}{b_i}} X_{i+1}^{-\frac{b_{i+1}}{b_i}} \ldots X_n^{-\frac{b_n}{b_i}}$$

the total cost function for output, Y. Since the average cost is equal to total cost divided by total output, dividing equation 2 by Y results in equation 3,

$$(3) \quad \text{Average Total Cost} = \sum_{i=1}^{n} P_{x_i} c^{-\frac{1}{b_i}} Y^{\frac{1}{b_i}-1} X_1^{-\frac{b_1}{b_i}} \ldots X_{i-1}^{-\frac{b_{i-1}}{b_i}} X_{i+1}^{-\frac{b_{i+1}}{b_i}} \ldots X_n^{-\frac{b_n}{b_i}}$$

the average cost per unit of output. This particular mathematical form, the power function, yields either increasing or decreasing average total cost. However, other mathematical forms of production functions exhibit

both increasing and decreasing average total cost of production.[2]

A swine operation requires many inputs, both human and non-human. The affect that these inputs have on the average cost function is directly affected by the length of run that is being considered. The short run, as discussed by Viner[3], is the length of time over which output can be varied by using more or less variable inputs with a physical plant that cannot be altered in size. Costs incurred in the short run are thus of two types. Variable costs such as the cost of feed and utilities in a hog operation, are those the decision maker can alter to cause increases and decreases in the level of output from the set of fixed facilities. Fixed cost is the combined value of the resources that do not change in the short run and are thus fixed in amount. This includes such inputs as buildings and equipment in the production of hogs. The long run represents the length of time needed to allow all resources, including plant size, to be varied thus resulting in all costs being variable to the producer.

Figure 2 illustrates both average fixed and average variable cost functions and how they vary as the output of the firm changes in the short run assuming plant size fixed.

Since fixed costs have to be met regardless of the level of output, then average fixed costs (AFC) for output, Y, is by definition a rectangular hyperbola. This means that as output increases the amount of fixed cost that each unit of output is "responsible" for declines.

---

[2]Earl O. Heady and John L. Dillion, Agricultural Production Functions (Iowa, 1971), pp. 59-60.

[3]Jacob Viner, "Cost Curves and Supply Curves," Readings in Price Theory, ed. G. J. Stigler and K. E. Boulding (Chicago, 1952), pp. 201-202.

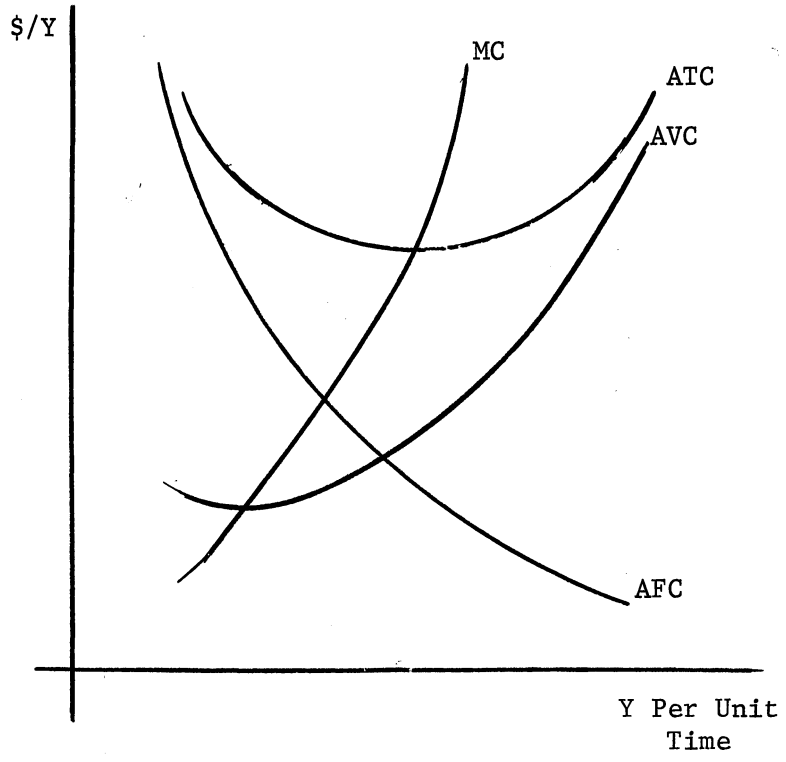

Figure 2. Short Run Cost Curves

This is what is meant by "spreading out the fixed cost".

Average variable costs (AVC) are the costs of variable resources divided by the number of units of output. The AVC curve may decrease during the early stages of production due to increased productivity of the variable resource applied to the fixed resources. The increase in AVC is due to the law of diminishing returns. Diminishing returns results from the increase in variable resources applied to a constant amount of fixed factors causing the productivity of the additional variable resources to decline and eventually the average productivity declines.[4]

Average fixed cost and average variable cost separately provide the decision maker with two different input cost-output relationships; AFC decreases as output increases and AVC increases as output increases. For per unit analysis to be useful, it is necessary to consider both simultaneously.

Average total cost (ATC) is average fixed cost plus average variable cost. Any element that affects their shape (AFC and AVC) also affects the shape of the average total cost relationships. The rate at which ATC declines to its minimum point as output increases is determined by the relative importance of fixed and variable costs. The rate at which ATC increases as output is increased is directly affected by the degree that variable resources are affected by diminishing returns, meaning that the decrease in the efficiency of the variable resources (increase in AVC) more than offsets the increasing efficiency of the

---

[4]Ibid., p. 203.

fixed resources.[5]

Marginal cost (MC) represents the amount that each additional unit of output adds to total cost. Marginal cost equals ATC at its minimum point. The reasoning is that as long as MC is less than ATC, the marginal effect on the total causes the average to decline. Where MC exceeds ATC the marginal effect causes the average to increase.

Assuming that the hog producer is operating under conditions approaching pure competition, as presented by Leftwich,[6] his profit maximizing level of output is where marginal cost of producing the last unit of output equals the marginal revenue (price of the product) of that same unit of output ($MC = MR = P_y$). Since any one hog producer supplies an insignificant amount of the industry output, his level of output has no affect on the price of pork, and the marginal revenue equals the price. If the price of pork is $40 per hundred-weight, then he produces and sells pork until the cost of producing the last additional 100 pounds of pork is $40. At levels of output less than MC equals MR, more is added to total revenue than to total costs as output increases, thus increasing profits. In the short run, which indicates some fixed resources, it is beneficial for the producer to operate at a level of output such that the price of pork equals marginal cost as long as the price exceeds AVC of producing pork. At any price of output above AVC the entrepreneur is recovering payment for all of the variable resources and for at least part of the fixed resources. Should the price of pork fall below AVC, the producer would not operate, because

---

[5]Richard H. Leftwich, The Price System and Resource Allocation (New York, 1966), p. 137.

[6]Ibid., p. 22.

he would not return enough to pay for variable resources. In the short run, then, the hog producer theoretically needs input-output information such that he is combining his inputs to produce at that level of output where short-run marginal cost equals marginal revenue.

Economies of Size

Economies of size can probably be best defined as the lowering of per unit costs as the amount of output is increased due to changes in the size of the plant. The long run is the length of time needed to permit changes in the resources, such as plant size, that are fixed in the short run.

The situation is illustrated in Figure 3. The hog farmer is faced with various sizes of hog facilities, indicated here by short run average total cost (SAC) curves 1 thru 5, from which to choose. The long run average cost curve (LAC), drawn tangent to the short run average cost curves, assumes all resources, including building size, variable. This curve represents the most efficient combination of inputs to produce any level of output, with the combination of resources depicted by SAC_3 representing a plant size that is the least cost size for production of pork.

In the long run, assuming that the entrepreneur is operating under conditions of pure competition, price of his output tends to move to a level such that returns to the resources are just adequate to maintain that resource in its use. This occurs at or near the plant size that has SAC_3; and price of pork, P_y in Figure 3. Economic profit is zero and for the hog producer to combine inputs to produce more or less pork results in loss. Thus, the conditions of pure competition in the long

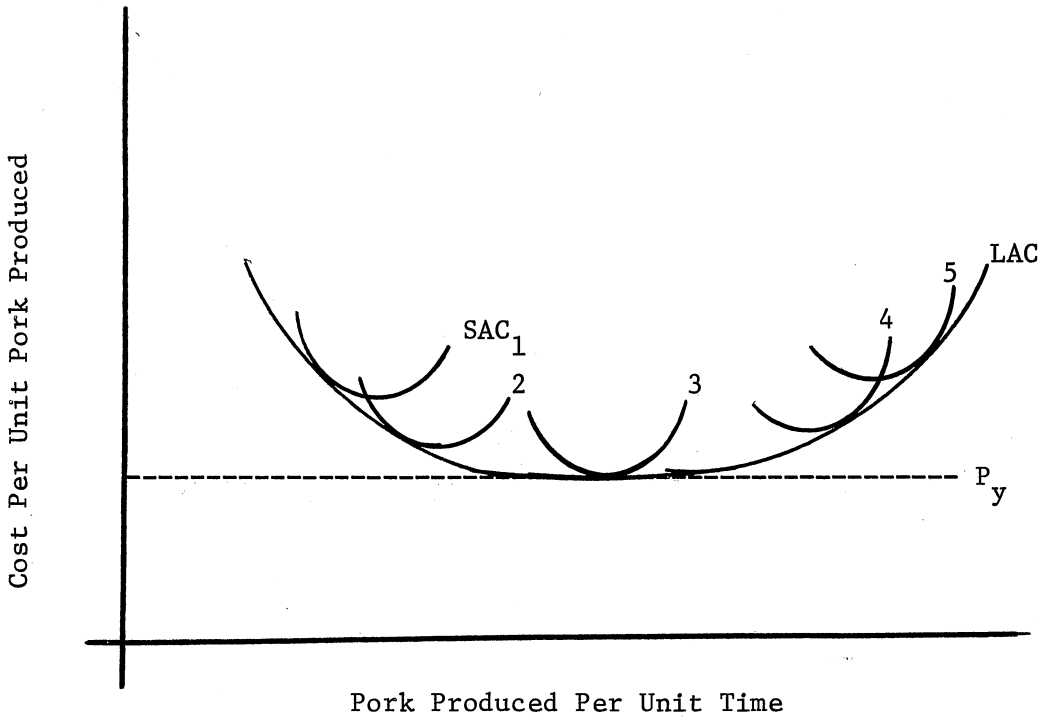

Figure 3. Long Run Cost of Producing Pork

run forces the entrepreneur to continually alter his combination of resources in an attempt to achieve plant size SAC_3. The LAC is the economies of size curve that, theoretically, determines the combination of resources and quantity of output that is optimal for the swine farm in the long run.[7] The shape of this curve is the result of net internal and external economies as output levels change.

Net internal economies (diseconomies) cause decreases (increases) in per unit costs as firms expand output along their LAC curve. If LAC is decreasing, the internal economies gained are greater than the internal diseconomies. Internal economies are of two forms: 1) technological and 2) pecuniary. Technological internal economies are the reduction in per unit costs that result from more efficient use of resources due to improved organization of these resources or use of methods of production that are made possible by the increase in size of the resources.[8] By increasing the size of the hog operation the producer may realize per unit cost savings in the use of specialized labor or sophisticated machinery, such as automatic feeding devices. Pecuniary internal economies result from the ability of larger firms to reduce the price of resources through the use of such things as discount buying when large amounts of resources are obtained. Internal diseconomies are generally attributed to management and coordination difficulties that arise when firms increase output through expansion of plant size.[9]

---

[7]J. P. Madden, Economies of Size in Farming, Agricultural Economic Report 107 (Washington, D. C., February, 1967), pp. 3-5.

[8]Viner, pp. 212-213.

[9]Stigler, pp. 137-138.

Reduction in per unit long run costs may be caused by factors external to the firm. These external economies and diseconomies result from expansion of output by the entire industry. Technical external economies result from factors such as better organization of the resource markets and more efficient communication that comes from having more firms in the industry. Pecuniary economies result from the reduction in the price paid for resources by the firm as the entire output of the industry increases. As industry output increases, use of resources is by definition also increasing enabling the firms that produce the resource to incur net internal economies and thus sell their output at a lower price. The national shift of hog production from the small pasture operation to the large total confinement systems has probably resulted in lower hog feed costs and equipment costs as feed dealers and manufacturers lowered their per unit cost because of the increased use of these inputs. External diseconomies cause the per unit costs to rise as industry output increases. This is caused by the increase in market demand for resources making higher resource prices.

Increasing technical efficiency and pecuniary economies available to Oklahoma hog producers lead to decreasing per unit pork production costs as output and plant size increase from low output levels. For a certain range of output there appears to be relatively few economies or diseconomies as the size of operation increases until the ability to manage the operation and achieve the same level of technical efficiency results in higher per unit costs. This indicates hog producers can achieve approximately the same average cost level over a wide range of outputs as indicated by the flat section of the LAC curve in Figure 3. Thus, the individual hog entrepreneur in the long run achieves an effi-

cient plant size somewhere on the flat portion of the LAC curve. It is assumed that the budgets presented in the following chapter represent inputs, outputs and costs for a firm operating at a point on this section of the LAC curve.

Vertical Coordination

When discussing economies of size, it is stated that the difference between the short run and the long run is that in the short run plant size is fixed where as in the long run all resources are variable. Thus, in the long run the physical plant becomes a variable resource for the firm, the firm being no more than the unit that organizes inputs to produce a product. When the swine entrepreneur is making long run decisions, he has several production processes from which to choose. First, he may decide to continue as is, if he feels that his is the most profitable way to produce hogs. Should he find that his is not the optimum available plant size, he can alter his combination of resources to take advantage of economies of size as an alternative. A third alternative is to integrate horizontally, which is basically a factor repetition of the optimum resource combination. Another choice facing the individual entrepreneur is vertical integration. This alternative can also be combined with the other choices and provide yet another combination of resources.[10]

Up to this point of the discussion the firm has been limited to one output with economic efficiency gained by increasing that output.

---

[10]Ronald L. Mighell and Lawrence A. Jones, Vertical Coordination in Agriculture, Agricultural Economic Report No. 19 (Washington, D. C., February, 1963), pp. 4-11.

The analysis has been held to one economic stage, with an economic stage being any process or production function that produces a product that is sold. Vertical integration is the combining of economic stages so that what once was a final product for the firm now becomes an intermediate good used to produce a different final good. The farrow-to-finish swine operation can be considered a combination of two economic stages, feeder pig production and finishing feeder pigs, into one operation. The economic advantage is if the farrow-to-finish operation can produce slaughter hogs at a per unit cost that is less than the combined cost of having the hogs produced by a feeder pig farmer and sold to another farmer finishing feeder pigs. This may be the case for the integration because some of the buying and selling costs have been eliminated in the farrow-to-finish operation. There are other factors such as transportation costs that produce similar types of economies that might further reduce per unit costs. In general, though, the situation is as shown in Figure 4. Curves s_1 m_1 .... s_6 s_6 represent the LAC curves of separate firms performing each of the economic stages that might be integrated. Curves S_1 M_1 .... S_6 S_6 represents the LAC curves as additional economic stages are integrated with the previous process to yield a vertically integrated firm. The shape of these LAC curves for the latter firms indicates that as additional stages are added the complexity of the operation will cause the lowest level of output at which minimum costs are realized to be higher than at the previous stage. Thus, if a firm is to expand vertically, there will also be a need to expand horizontally. Should there also be some managerial restraints, then the highest level of output at which minimum per unit costs are realized may be at successively lower levels of output as economic

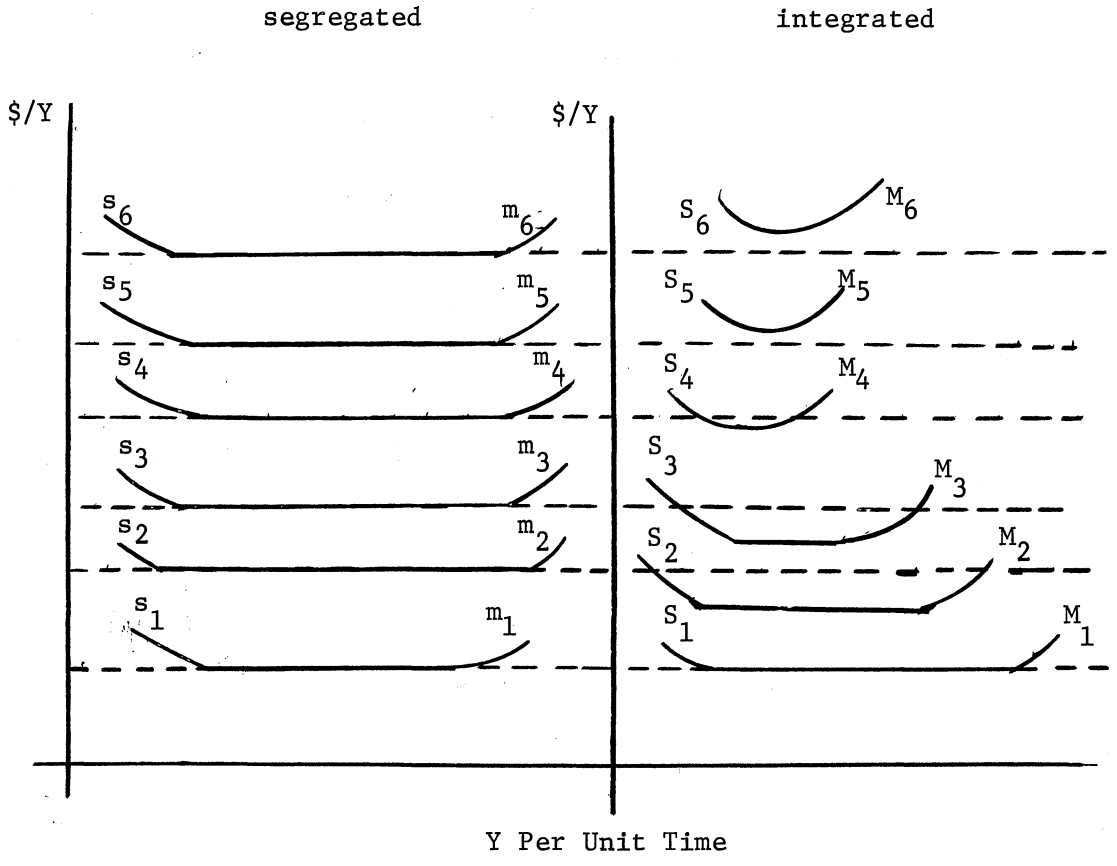

Figure 4. A Comparative Analysis of Segrated and Integrated Structures of Firms

stages are vertically integrated. The affect of organizational complexity then may be to limit the range over which integration and economies of size provide per unit cost savings until finally a combination of stages such as S_5 M_5 yields higher per unit costs then the segregated firms. Thus, the forces of pure competition will not permit this combination of integrated stages to exist without expansion of the managerial capacity.[11] It is partially because of this that there appears to be a reduction in the number of farms that raise their own feed grain for use in their swine operations.[12]

Estimation of Input-Output Relationship

There are two related problems encountered in estimating input-output relationships to provide planning information. First, which type of data is used and second, what technique is used to provide the information.

Data is classified as either experimental or nonexperimental data.[13] Nonexperimental data is based on historical time series or cross-sectional information obtained from past records of producing farms. The advantages of this type of data are the ease with which it is collected and its direct connection with actual world situations. The main disadvantage is the lack of control over important factors, such as management and technology levels, that affect costs and returns rela-

---

[11] Oswald P. Blaich, Vertical Integration in Theory, Report No. 520 (Minnesota, 1961), pp. 14-42.

[12] Oswald P. Blaich, "Integration in Theory With an Application to Hogs", J.F.E., Vol. XLII, No. 5 (December, 1960), pp. 1287-1296.

[13] Heady and Dillion, pp. 142-149.

tionships. Experimental data is generated by the researcher for hypothetical farms based on production coefficients estimated by the technical science involved. This type of data allows the researcher to control the factors deemed important to the study. Such things as levels of management and technology can be held constant in the analysis to determine the effect changes in the input-output relationship have on the profitability of the farm.

Once the data is collected, it is necessary to determine the appropriate approach to analyzing the input-output coefficients. One method is the actual estimation of SAC and LAC curves for marginal analysis. Statistically, the least squares method is one way of estimating costs curves from nonexperimental data. The problem that arises from using this method is that it fails to differentiate between changes in output due to better utilization of the existing plant versus changes in output due to changes in the plant size. If it is possible to distinguish plant capacity and to fit the regression line to only the well designed, fully utilized farms, then the problem arises in having an adequate sample size especially for large output farms.[14] Another approach to estimating cost curves is the synthetic-firm method that employs budgeting if there are few types of firms from which to choose and linear programming as the mathematical technique where the number of firms is large. With either technique the basic objective is to minimize cost of producing a level of output for a specific plant size; then as the output level is varied, minimum cost varies yielding a SAC curve. A LAC curve is then obtained by altering the plant size to com-

---

[14] R. G. Bressler, "Research Determination of Economies of Scale," J.F.E., Vol. XXVII, No. 3 (August, 1945), pp. 526-539.

pare their relative efficiency.[15]

Since adequate historical input-output data for confinement swine systems in Oklahoma does not exist, this study employs a synthetic-firm approach. The first step is to construct complete enterprise budgets for the three basic confinement swine systems (farrow-to-finish, feeder pig production, and the finishing of feeder pigs) in Oklahoma. These average annual budgets, presented in Chapter III, are based on investment requirements and costs estimated by extension agricultural engineers, and operating requirements and expected output levels estimated by extension animal scientists, at Oklahoma State University.

Cost information is also developed for on-farm feed processing and on-farm grain storage as potential economic production stages to be vertically coordinated with the three basic systems.

Since it is the objective of this study to compare various systems that employ differing production processes and not to evaluate any one particular system, it is assumed that each budgeted system is the most efficient combination of resources for that operation. Theoretically then, referring to Figure 3, each system represents a hog farm with a SAC curve on the flat section of the LAC curve.

Chapter IV compares the various swine systems, based on the average annual returns to land, overhead, risk and management. Returns are the summed amount by which the price of the output exceeds the average cost of producing each unit of output. So, any change in the level of returns without a change in the output of the enterprise or the output price, indicates a change in the average cost of production and any

---

[15]Madden, pp. 29-33.

changes in the relative change in their average cost of production.

Based then on the average annual costs and returns budgets, four different analyses are performed to provide planning information for present and potential swine producers. First, an "equitable" feeder pig pricing formula is calculated so that the ratio of the returns for feeder pig production to the returns for finishing feeder pigs equals the ratio of the amount of labor involved in the two operations. Second, based on an "equitable" feeder pig price, all enterprises are budgeted at differing capital cost rates to provide the individual farmer with planning information based on the price he pays for capital. Third, discounted present value of estimated returns to each basic system are calculated and compared to investment requirement costs to provide the discounted net yield of each system to indicate the profitability of the alternative investments.[16] A cash flow analysis provides planning information in the form of loan requirements and time period required to pay for the system.

---

[16]William J. Baumol, Economic Theory and Operations Analysis (New Jersey, 1972), pp. 461-471.

CHAPTER III

CONFINEMENT SWINE OPERATIONS FOR OKLAHOMA

The production of slaughter hogs is typically analyzed in terms of a farrow-to-finish operation. This type of operation involves all phases of a hog life cycle beginning with the breeding of the sow through finishing and sale of slaughter hogs. Farrow-to-finish production is composed of two stages of production that in themselves are potential swine operations. The farrowing of the litter and nursing the pigs results in a product, feeder pigs, that either goes on to the same producer's growing and finishing floor or is sold to another firm for finishing. The production of feeder pigs is one stage of production. The growing and finishing steps of a farrow-to-finish operation form a second stage of swine operations, commonly referred to as the finishing of feeder pigs. Each of these three production operations (farrow-to-finish, feeder pig production and swine finishing) are analyzed in this study. To further explore possible forms of integration, it is necessary to consider either the production of resources or the processing of output. Based on the level and type of management assumed, on-farm feed processing and grain storage is a likely production stage to be integrated with the three systems. The purpose of this chapter is to first present the three basic swine systems and then to present these systems as integrated with feed processing and grain storage.

Farrow-to-Finish

Historically, the farrow-to-finish operation was considered a supplementory enterprise, performed on pasture employing the resources that were left over from the farms main enterprises. With the level of technology and prices prevailing in recent years, this type of operation has become one that uses highly specialized resources, such as environmentally controlled confinement buildings, on a relatively constant basis throughout the year. There exist numerous types of technology that come under the heading of confinement facilities. The one a farmer uses is a function of his managerial ability, preferences, resources and financial capabilities. The system used for this analysis is chosen because 1) it displays the characteristics of present day swine production technology, 2) of its adaptability to hog operations other than farrow-to-finish, 3) it is designed for expansion and 4) reliable construction and investment estimates are available.

Livestock Investment and Production

The Breeding Herd. The breeding herd consists of 100 sows, 5 boars and replacement gilts. Sows are marketed following their second litter. Sows or replacement gilts that do not breed are sold within two weeks of the time that it is discovered that they have not bred. Boars are replaced every year. The initial investment in the breeding herd consists of: 1) 100 sows at a cost of $100 per sow and 2) 5 boars at a value per head of $300. Since gilts are saved as replacements, only the initial 100 gilts are purchased off the farm.

The Production Schedule. The 100 sows are divided into three groups (2 thirty-three sow groups and one group of 34). A 90 percent conception rate is assumed such that 30 sows for each group farrow.

The length of breeding time is 3 weeks and scheduled so that the multiple farrowings are at eight week intervals, resulting in 6.5 litter groups farrowed per year. Assuming that the above average management obtains an average litter size of eight pigs, the 100 sows, as shown in Table II, produce 1560 gilts and barrows per year. Of these 1435 market hogs sold annually. Annual sales also includes 19 sows that do not breed, 105 sows sold after their second litter, and the 5 boars.

The time schedule for each group of sows includes the three-week breeding period, a thirteen-week gestation period, followed by a farowing-lactation period of eight weeks. The pigs are weaned at 4 to 6 weeks of age and moved to the grower. Grower time for the pigs average 7 weeks. At approximately 13 weeks of age the pigs are moved to the finishing building. It is assumed that one-third of each litter achieves market weight and is sold after eight weeks on the finishing floor, one-third after ten weeks, and the remaining hogs are sold after twelve weeks. The slaughter barrows and gilts are assumed to average 220 pounds when marketed. Thus, the most efficient pigs are assumed to reach 220 at the age of 21 weeks, while the least efficient require 25 weeks to reach market weight. A more detailed presentation of this production schedule is contained in OSU Fact Sheet 1208.[1]

---

[1]Pete Bloome et al., 100-Sow, Farrow-to-Finish Swine System (Stillwater, 1974).

TABLE II

PRODUCTION COEFFICIENTS FOR DETERMINING ENTERPRISE OUTPUT

Output Item	Production Process: Farrow to Finish	Production Process: Feeder Pig Production	Production Process: Finish Feeder Pigs
Breeding			
Sows Bred	216	216	--
Sows Farrowed (%)	195 (90)	195 (90)	--
Farrowing			
Litters	195	195	--
Pigs to Grower	1,560	1,560	--
Average Per Litter	8	8	--
Marketing			
Slaughter Hogs	1,435	--	1,511
Pounds Slaughter Hogs	315,700	--	332,420
Average Weight	220	--	--
Sows	124	124	--
Pounds Sow Sold	44,550	44,550	--
Average Sow Weight	359	359	--
Feeder Pigs	--	1,435	--
Pounds of Feeder Pig	--	71,750	--
Average Weight Feeder Pigs	--	50[A/]	--/
Total Pounds Pork Sold	362,250[A/]	118,300[A/]	332,420

[A/] Includes sale of 5 four-hundred pound boars.

An average annual price of $40 per hundred-weight for slaughter hogs is used to compute receipts. This price is adjusted monthly using a centered, 12 month moving average, seasonal index as shown in Table III. Hogs are marketed approximately every eight weeks in groups of

240 pigs minus the replacements. The 19 non-breeders are sold at an average weight of 300 pounds for $37 per hundred-weight. Sows sold after their second litter average 370 pounds and are valued at $36 per hundred-weight. Five 400 pound boars are sold for $32 per hundred-weight.

Inputs

Buildings and Equipment Costs. The main physical facilities, based on agricultural engineer designs, consist of: 1) a thirty crate slatted floor farrowing house, 2) a ten pen slatted floor grower and, 3) a finishing building with twenty partially slatted pens. A more detailed description is presented in Table IV. As shown, this system also includes a lagoon for manure disposal and nine outside pens with shelters for the breeding herd. Information concerning site selection and arrangement is contained in OSU Fact Sheet 1208.[2] Other equipment includes a water system, a standby generator, a used tractor, feed trailer and a 1/2 ton pickup truck.

The initial investment for the items in Table IV is $83,200. This cost can be expected to vary by as much as $7,000 depending on local conditions and the amount of construction responsibility assumed by the owner-operator. Turn-key construction cost for an identical facility is estimated to be from $100,000 to $150,000.

Feed Requirements and Costs. The rations assumed and the ingredients of the rations are based on recommendations by Oklahoma State University swine nutritionists.[3] The rations are given in Table V.

---

[2] Ibid.

[3] Vernon Stevens and William Luce, Swine Nutrition (Stillwater, 1972).

TABLE III

SEASONAL PRICE INDEXES FOR SLAUGHTER HOGS, MILO AND SOYBEAN MEAL[A/]

Months	Hogs	Milo	Soybean Meal
Jan.	101.32	99.74	98.75
Feb.	111.82	101.35	99.58
Mar.	101.35	101.75	99.06
Apr.	94.69	101.82	97.89
May	98.88	100.78	98.47
June	103.31	100.60	99.48
July	110.44	103.18	101.30
Aug.	102.92	101.80	102.68
Sep.	97.76	98.16	102.60
Oct.	93.35	95.47	101.50
Nov.	89.36	97.39	100.14
Dec.	94.79	97.95	98.54

[A/] Oklahoma Farm Prices, from USDA-SRS Agricultural Prices, for 1965-1972 are used to calculate the indexes. Actual calculation is done by a computerized centered 12-month moving average program by Dr. Paul Hummer, Agricultural Economist, Oklahoma State University.

TABLE IV

PHYSICAL FACILITIES FOR THE 100 SOW FARROW-TO-FINISH SWINE SYSTEM

Item	Description	Size	Initial Investment
Farrowing Building [A/]	30 crates on partially slatted floors; 15 on each side of 4 ft. alley way.	24' X 84'	$27,000
Grower Building [A/]	10 pens, 8 ft. X 10 ft.; five pens on each side of 4 ft. alley way.	24' X 48'	13,000
Finishing Building	20 pens 8' X 30' on slatted floors with 4' alley way in front of pens.	34' X 160'	23,500
Lagoon	160 ft. frontage X 115 ft. wide X 10 ft. deep.		2,400
Sow and Boar Pens	1 pen with shelter 15 ft. X 20 ft. (for new gilts).	20' X 100'	
	4 pens with shelter 10 ft. X 15 ft. (for sows and gilts held for breeding).	20' X 100'	
	2 gestation pens with shelter 15 ft. X 30 ft.	100' X 200'	
	4 pens for boars with shelter	10' X 50'	8,000
Water System and Generator			3,500
Tractor and Trailer	Used	55 H.P.	2,300
Pickup	1/2 ton		3,500
			$83,200

[A/] The farrowing and growing facilities would typically be included in one structure.

TABLE V

FEED REQUIREMENTS

Type	Starter	Grower	Finisher	Breeder
Fed to Pigs From	One week to 40 lb.	40 lb. to 120 lb.	120 lb. - Market	--
Ingredients				
Milo	617	1510	1620	1432
Corn	637	--	--	--
Soybean Meal	540	435	325	413
Sucrose	50	--	--	--
Whey	100	--	--	--
Salt	10	10	10	10
Dicalcium Phos.	36	30	30	30
Calcium	10	15	15	15
Vitamin Trace[A/]	--	--	--	--
Alfalfa Meal	--	--	--	100
TOTAL	2000	2000	2000	2000
Percent Protein	18	16	14	14
Pounds Feed/Pound Gain	2.0	3.1	4.05	--
Yearly Ration Needs in				
Tons for 100 Sow Farrow-to-Finish Unit	31.2	152.1	334.13	130.03
Tons for 100 Sow Feeder Pig Production Unit	31.2	11.7	37.8	130.03
Tons for Finishing Feeder Pig Unit	--	187.0	315.9	--

A/ Add vitamin trace according to recommendations. The amount required usually is within the range of 2.5 to 10 pounds per ton.

The three rations fed to the hog from the time it is weaned until finished are the starter, fed from one week of age until the pig weighs 40 pounds, followed by the grower ration fed until the pig weighs 120 pounds, and the finishing ration fed from 120 pounds to market weight. The feed efficiency estimates presented in Table V were prepared by OSU swine nutritionists assuming above average management.[4] Based on the feed efficiency estimates and the length of time on each feed, it is calculated that a 100-sow farrow-to-finish operation requires 31.2 tons of starter ration per year, 152.1 tons of grower, and 334.13 tons of finishing ration per year. This system also requires yearly 130.03 tons of breeder ration for the sows and boars.

These feed requirements imply an overall efficiency of 3.6 pounds of feed per pound of pork sold or 4.12 pounds of feed per pound of slaughter hog sold.

The bimonthly ration requirements throughout the year are calculated using the production schedule and the information in Table V. The amounts of milo and soybean meal needed bimonthly are presented in Table VI. The quantities required of the other ingredients are treated as a yearly amount because: 1) the price of these does not show a cyclical movement or 2) the level used bimonthly is too small to significantly affect costs and returns.

The bimonthly ration requirements are multiplied by seasonally adjusted prices for the ingredients to arrive at the cost for the feed. The monthly price indexes for milo and soybean meal given in Table III are based on Oklahoma monthly average farm prices for 1965 through 1972.

---

[4] Ibid.

TABLE VI

AVERAGE ANNUAL COSTS AND RETURNS FOR THE 100-SOW FARROW-TO-FINISH SWINE SYSTEM

PRODUCTION	UNITS	QUANITY	WEIGHT	PRICE	VALUE/UNIT	VALUE
SLAUGHTER HOGS	HD.	103.00	2.20	40.520	89.14	9181.82
SLAUGHTER HOGS	HD.	207.00	2.20	44.720	98.38	20365.47
SLAUGHTER HOGS	HD.	237.00	2.20	37.880	83.34	19750.62
SLAUGHTER HOGS	HD.	237.00	2.20	41.320	90.90	21544.23
SLAUGHTER HOGS	HD.	237.00	2.20	41.160	90.55	21460.81
SLAUGHTER HOGS	HD.	207.00	2.20	37.320	82.10	16995.52
SLAUGHTER HOGS	HD.	207.00	2.20	37.920	83.42	17268.76
SOWS	HD.	19.00	3.00	37.000	111.00	2109.00
SOWS	HD.	105.00	3.70	36.000	133.20	13985.99
BOAR	HD.	5.00	4.00	32.000	128.00	640.00
TOTAL RECEIPTS						143302.06

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PRICE	VALUE
MILO	CWT.	1561.00	1.00	1561.000	3.99	6228.39
MILO	CWT.	1585.00	1.00	1585.000	4.07	6450.95
MILO	CWT.	1618.00	1.00	1618.000	4.03	6520.54
MILO	CWT.	1629.00	1.00	1629.000	4.13	6727.77
MILO	CWT.	1627.00	1.00	1627.000	3.93	6394.11
MILO	CWT.	1630.00	1.00	1630.000	3.90	6357.00
SOYBEAN MEAL	CWT.	394.00	1.00	394.000	7.89	3108.66
SOYBEAN MEAL	CWT.	408.00	1.00	408.000	7.92	3231.36
SOYBEAN MEAL	CWT.	411.00	1.00	411.000	7.88	3238.68
SOYBEAN MEAL	CWT.	412.00	1.00	412.000	8.10	3337.20
SOYBEAN MEAL	CWT.	411.00	1.00	411.000	8.21	3374.31
SOYBEAN MEAL	CWT.	412.00	1.00	412.000	8.00	3296.00
SALT	CWT.	64.80	1.00	64.800	2.10	136.08
DICAL PHOSPHATE	CWT.	195.00	1.00	195.000	3.10	604.50
CALCIUM	CWT.	96.00	1.00	96.000	1.80	172.80
CORN	BU.	360.00	1.00	360.000	2.50	900.00
SUCROSE	CWT.	15.60	1.00	15.600	10.00	156.00
DRIED WHEY	CWT.	31.20	1.00	31.200	9.00	280.80
VIT TRACE	CWT.	12.00	1.00	12.000	50.00	600.00
ALF MEAL	CWT.	150.00	1.00	150.000	4.50	675.00
VET & MED.	HD.	1764.00	1.00	1764.000	1.50	2646.00
GRIND & MIX FEED	TONS	648.00	1.00	648.000	7.00	4536.00
SELL & HAULING	HD.	1559.00	1.00	1559.000	1.50	2338.50
BOAR PIGS	HD.	5.00	1.00	5.000	300.00	1500.00
UTILITIES	DOL.	12.00	1.00	12.000	106.26	1275.12
OPER. TAX & INS.	DOL.	35420.00	1.00	35420.000	0.02	665.90
TRACTOR FUEL COST						19.17
TRACTOR REPAIR COST						50.81
TRACTOR LUBE COST						2.87
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						36.92
EQUIPMENT REPAIR						2205.00
TOTAL OPERATING COST						77256.19
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT						66045.88

CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	38623.082	3862.31
TRACTOR INVESTMENT	0.100	304.454	30.45
MACHINERY INVESTMENT	0.100	1214.760	121.48
EQUIPMENT INVESTMENT	0.100	42449.934	4244.99
LIVESTOCK INVESTMENT	0.100	11499.996	1150.00
TOTAL INTEREST CHARGE			9409.21
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT			56636.66

OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)		
TRACTOR	DOL.	40.97
MACHINERY	DOL.	247.38
EQUIPMENT	DOL.	9756.29
LIVESTOCK	DOL.	216.20
TOTAL OWNERSHIP COST		10260.83
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT		46375.83

LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	361.199	1083.60
LIVESTOCK LABOR	3.000	2040.000	6120.00
TOTAL LABOR COST			7203.59
RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT			39172.23

The monthly seasonal adjusted prices in Table VI are based on an average annual price of $4 per hundred-weight for milo and $8 per hundred-weight for soybean meal. The cost of other feed ingredients listed in Table VI is based on prices quoted for central Oklahoma in October of 1974. A grinding and mixing charge of $7 per ton is included on the 648 tons of feed that the entire operation requires yearly.

Labor Requirement and Cost. Detailed input studies for swine operations in Indiana, Iowa and Texas indicate that a 100-sow farrow-to-finish operation, with the type of facilities assumed, requires about 2,400 hours of labor per year.[5] Eighty-five percent of this time is used for livestock and 15 percent is machinery labor. Since the work involved in operating a farrow-to-finish system involves a great deal of attention to detail, it is assumed that a wage rate of $3 per hour must be paid to attract the skilled labor required. Should the owner be the operator the $3 per hour is assumed to be withdrawn for family living expenses.

Other Operating Inputs and Costs. One expense that any swine producer definitely incurrs is veterinary services and medical supplies. The cost of these varies by location and management practices but estimates from animal scientists indicate that the average cost of such services is $1.50 per slaughter hog produced. This includes routine practices and unexpected medical requirements that may arise.

---

[5]Larry D. Trede, "Cost and Returns of Different Swine Production System," EC-673, Cooperative Extension Service, Iowa State University (Iowa, 1971), p. 5; see also A. E. Lines and D. H. Bahe, "Planning Data for Hog Farms," Cooperative Extension Service, Purdue University (Indiana, 1972), pp. 14-15; see also T. R. Owens, J. C. Snodgrass and H. Y. Lee, "Labor Utilization Confinement Rearing of Swine Texas High Plains," ICASAE Special Report No. 45 (Texas, 1971), pp. 3-14.

A blanket policy insurance charge and a tax charge are included on the slaughter hogs that are being produced. Based on the production schedule the production process repeats itself approximately every six months, so an average cash value is calculated as one-half of the total first six months receipts to arrive at an estimate of the value of the slaughter herd on any one day of the year. An insurance rate of $.88 per $100 cash value and a tax rate of $10 per $1,000 cash value are based on central Oklahoma Farm Bureau Insurance rates and advalorem tax rates.

Marketing and hauling costs of $1.50 per hog sold are charged.[6] Utilities totaling $1,275 per year and the fuel, lubrication and repair costs for 180 hours of pickup truck and 132 hours of tractor operation per year are included. Replacement boars must be purchased each year. The assumed cost is $1,500.

Comparison of Annual Costs and Returns

The average annual costs and returns budget generated for the 100-sow farrow-to-finish swine system is given in Table VI. Based on the farrowing, breeding and marketing data from Table II, average annual gross receipts, which include the sale of barrows, gilts, nonbreeders, sows and boars, for the farrow-to-finish operation total $143,302.06.

Total average annual costs as shown in Table VII are $104,129.83 or $28.74 for every hundred pounds of pork sold. This includes operating costs ($77,256.19), capital cost ($9,409.21), ownership cost

---

[6]David Bache, "Cost and Returns in Hog Production Detail Budgets for the Swine Enterprise" (Paper presented at Annual Extension Workers Conference, Purdue University, October 1971, Indiana).

TABLE VII

INPUT COEFFICIENTS FOR DETERMINING ENTERPRISE OPERATING COSTS

Inputs Item	Production Process: Farrow to Finish	Feeder Pig Production	Finish Feeder Pigs
Feed Fed			
Hundred-Weight	12,949.2	4,171.8	10,058.0
Per lb. Pork Sold	3.6	3.5	3.02
Per lb. Sl. Hog Sold	4.12	--	3.02
Per lb. Feeder Sold	--	5.8	--
Feed Cost[A]			
Total	66,325.65	22,287.50	50,982.13
Per Pound of Feed	5.1¢	5.3¢	5.06¢
Per lb. Pork Sold	18.3¢	18.8¢	15.3¢
Per lb. Sl. Hog Sold	21.0¢	--	15.3¢
Per lb. Feeder Sold	--	31.0¢	--
Other Operating Input Costs			
Total	$10,930.54	$7,943.88	$52,145.79[B]
Per lb. Pork Sold	3.0¢	6.7¢	15.7¢[B]
Per lb. Sl. Hog Sold	3.4¢	--	15.7¢[B]
Per lb. Feeder Sold	--	11.1¢	--
Capital, Ownership and Labor Costs			
Total	$26,873.64	$18,120.09	$13,821.39
Per lb. Pork Sold	7.4¢	15.3¢	4.1¢
Per lb. Sl. Hog Sold	8.5¢	--	4.1¢
Per lb. Feeder Sold	--	25.2¢	--
Total Cost			
Total	$104,129.83	$48,351.48	$116,948.83
Per cwt. Pork Sold	$28.74	$40.87	$35.18
Per cwt. Sl. Hog Sold	$32.98	--	$35.18
Per cwt. Feeder Sold	--	$67.39	--

[A] Includes grinding and mixing cost.

[B] Includes feeder pig purchases.

($10,260.83) and labor cost ($7,203.59). Operating costs include feed, veterinary expense, marketing charges, utilities, tax on slaughter hogs, insurance on slaughter hogs, replacement boars, fuel and repairs. Feed costs, including grinding and mixing, account for $66,325.65 or 63.6 percent of total cost. The other operating inputs, excluding labor, total $10,930.54 or 10.4 percent of total cost.

The capital cost is the interest charge (actual or opportunity) for the annual capital used in this farrow-to-finish operation. This is charged on both average annual operating capital and average investment capital. The average annual operating capital ($38,623.08) is the sum of the monthly cash operating expense multiplied by the fraction of the year it takes to recover the capital through sale of the hogs. The investment capital for depreciable items is the average amount of money invested in these items over the number of years they are used. Thus, the investment capital amount is understated for early years of operation and overstated for later years. The annual capital, or cash value of all capital resources used each year, is $94,092.10 for this farrow-to-finish operation. Assuming an interest rate of 10 percent means a total interest charge of $9,409.21 or 9 percent of the total cost is payment for annual capital cost.

The ownership cost of $10,260.83 is for depreciation, taxes and insurance on equipment, buildings, and machinery, and for insurance and taxes on the breeding herd. This cost represents 9.8 percent of total cost. The last input considered is labor. The labor requirements for this system are 361 hours for machinery labor and 2,040 hours yearly for livestock labor. With an hourly wage rate of $3, the total annual labor cost is $7,203, or 7 percent of total cost.

Reducing total receipts by total costs means that this 100-sow farrow-to-finish operation has returns to land, overhead, risk and management of $39,172.23.

Feeder Pig Production

The farm that produces feeder pigs for sale is the same as the farrow-to-finish operation except for the growing and finishing stages. Instead of the sale of 220 pound barrows and gilts the feeder pig operation sells 50 pound feeder pigs.

Livestock Investment and Production

The Breeding Herd. Like the farrow-to-finish system the feeder pig operation consists of 100 sows, 5 boars and replacement gilts. Thus, the investment in the breeding herd and any sale of the breeding herd is the same for both types of operation.

The Production Schedule. The sows are grouped and bred in the same manner as they are in the farrow-to-finish operation, resulting in 6.5 farrowings per year with an average of eight pigs per litter weaned. With 125 fifty pound gilts saved as replacements, 1,435 feeder pigs are sold annually. The pigs are weaned at 4 to 6 weeks of age and spend an average of 4 to 6 weeks on the grower floor. It is assumed they are 9 to 10 weeks old when sold as 50 pound feeders. Replacement gilts remain in the grower until they near breeding age and weight.

The price at which the feeder pig is sold is determined by a formula based on the market price of slaughter hogs. This price, after being seasonally adjusted using the index in Table III, is multiplied by a factor of 1.6 to arrive at the value per hundred-weight for the

first 40 pounds of each pig. The remaining pounds are sold at the seasonally adjusted market price. Using the seasonally adjusted annual slaughter price of $40 per hundred-weight, the formula results in an average price of $59.33 per hundred-weight for feeder pigs, or $29.66 per head. Sows and boars are sold at the same price as indicated in the farrow-to-finish operation.

Inputs

Building and Equipment Costs. The main facilities consist of: 1) a 30 crate slatted floor farrowing house and 2) a 10 pen slatted floor grower. This system also includes a lagoon and outside pens for breeding and gestation. Equipment required includes a water system, stand-by generator, used tractor, feed trailer, and one-half ton pickup truck. A more detailed description is presented in Table VIII. The initial investment for the items in Table VIII is $59,700 although this will vary by location and construction conditions.

Feed Requirements and Costs. The rations and their ingredients are based on the rations presented in Table V. Using these rations the production schedule and the feed efficiency, as assumed in the farrow-to-finish operation, results in yearly ration requirements of 31.2 tons of starter, 11.7 tons of grower, 37.8 tons finishing and 130.03 tons of breeding ration. The yearly ingredients required are presented in Table IX and prices assumed are identical to the ingredient prices for the farrow-to-finish operation.

Labor Requirements and Costs. It is assumed, based on detailed

TABLE VIII

PHYSICAL FACILITIES FOR THE 100 SOW FEEDER PIG PRODUCTION SYSTEM

Item	Description	Size	Initial Investment
Farrowing Building[A/]	30 crates on partially slatted floors; 15 on each side of 4 ft. alley way.	24' X 84'	$27,000
Grower Building[A/]	10 pens, 8 ft. X 10 ft.; five pens on each side of 4 ft. alley way.	24' X 48'	13,000
Lagoon	160 ft. frontage X 115 ft. wide X 10 ft. deep.		2,400
Sow and Boar Pens	1 pen with shelter 15 ft. X 20 ft. (for new gilts).	20' X 100'	
	4 pens with shelter 10 ft. X 15 ft. (for sows and gilts held for breeding).	20' X 100'	
	2 gestation pens with shelter 15 ft. X 30 ft.	100' X 200'	
	4 pens for boars with shelter	10' X 50'	8,000
Water System and Generator			3,500
Tractor and Trailer	Used	55 H.P.	2,300
Pickup	1/2 ton		3,500
			$59,700

[A/] The farrowing and growing facilities would typically be included in one structure.

TABLE IX

AVERAGE ANNUAL COSTS AND RETURNS FOR THE 100-SOW FEEDER PIG PRODUCTION SYSTEM

PRODUCTION	UNITS	QUANITY	WEIGHT	PRICE	VALUE/UNIT	VALUE
FEEDER PIGS	HD.	103.00	0.50	59.970	29.98	3088.45
FEEDER PIGS	HD.	207.00	0.50	66.180	33.09	6849.63
FEEDER PIGS	HD.	237.00	0.50	56.060	28.03	6643.11
FEEDER PIGS	HD.	237.00	0.50	61.150	30.57	7246.27
FEEDER PIGS	HD.	237.00	0.50	60.920	30.46	7219.02
FEEDER PIGS	HD.	207.00	0.50	55.230	27.61	5716.30
FEEDER PIGS	HD.	207.00	0.50	56.120	28.06	5808.42
SOWS	HD.	19.00	3.00	37.000	111.00	2109.00
SOWS	HD.	105.00	3.70	36.000	133.20	13985.99
BOAR	HD.	5.00	4.00	32.000	129.00	640.00
TOTAL RECEIPTS						59306.19

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PRICE	VALUE
MILO	CWT.	455.00	1.00	455.000	3.99	1815.45
MILO	CWT.	468.00	1.00	468.000	4.07	1904.76
MILO	CWT.	461.00	1.00	461.000	4.03	1857.83
MILO	CWT.	463.00	1.00	463.000	4.13	1912.19
MILO	CWT.	462.00	1.00	462.000	3.93	1815.66
MILO	CWT.	463.00	1.00	463.000	3.90	1805.70
SOYBEAN MEAL	CWT.	146.00	1.00	146.000	7.89	1151.94
SOYBEAN MEAL	CWT.	150.00	1.00	150.000	7.92	1188.00
SOYBEAN MEAL	CWT.	148.00	1.00	148.000	7.88	1166.24
SOYBEAN MEAL	CWT.	149.00	1.00	149.000	8.10	1206.90
SOYBEAN MEAL	CWT.	149.00	1.00	149.000	8.21	1223.29
SOYBEAN MEAL	CWT.	149.00	1.00	149.000	8.00	1192.00
SALT	CWT.	20.40	1.00	20.400	2.10	42.84
DICAL PHOSPHATE	CWT.	55.20	1.00	55.200	3.10	171.12
CALCIUM	CWT.	28.80	1.00	28.800	1.80	51.84
CORN	BU.	360.00	1.00	360.000	2.50	900.00
SUCROSE	CWT.	15.60	1.00	15.600	10.00	156.00
DRIED WHEY	CWT.	31.20	1.00	31.200	9.00	280.80
VIT TRACE	CWT.	6.00	1.00	6.000	50.00	300.00
ALF MEAL	CWT.	150.00	1.00	150.000	4.50	675.00
GRIND & MIX FEED	TONS	210.00	1.00	210.000	7.00	1470.00
BOAR PIGS	HD.	5.00	1.00	5.000	300.00	1500.00
VET & MED.	HD.	1764.00	1.00	1764.000	1.30	2293.20
SELL & HAULING	HD.	1559.00	1.00	1559.000	0.75	1169.25
UTILITIES	DOL.	12.00	1.00	12.000	70.00	840.00
OPER. TAX & INS.	DOL.	11910.00	1.00	11910.000	0.02	223.91
TRACTOR FUEL COST						19.17
TRACTOR REPAIR COST						50.81
TRACTOR LUBE COST						2.87
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						36.92
EQUIPMENT REPAIR						1617.50
TOTAL OPERATING COST						30231.38
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT						29074.81

CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	15152.066	1515.21
TRACTOR INVESTMENT	0.100	304.454	30.45
MACHINERY INVESTMENT	0.100	1214.760	121.48
EQUIPMENT INVESTMENT	0.100	29524.980	2952.50
LIVESTOCK INVESTMENT	0.100	11499.996	1150.00
TOTAL INTEREST CHARGE			5769.62
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT			23305.19

OWNERSHIP COSTS (DEPRECIATION, TAXES, INSURANCE)		
TRACTOR	DOL.	40.97
MACHINERY	DOL.	247.38
EQUIPMENT	DOL.	6802.34
LIVESTOCK	DOL.	216.20
TOTAL OWNERSHIP COST		7306.88
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT		15998.31

LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	361.199	1083.60
LIVESTOCK LABOR	3.000	1320.000	3960.00
TOTAL LABOR COST			5043.59
RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT			10954.71

labor studies for swine operations,[7] that a 100-sow feeder pig operation such as this will require 1,600 hours of labor annually. Seventy-eight percent is used for livestock and 22 percent is machinery labor. A wage rate of $3 per hour is assumed.

Other Operating Inputs and Costs. Veterinary services and medical supplies are charged at $1.30 per hog. Marketing and hauling costs are $.75 per pig sold. Utilities total $840 per year and fuel, lubrication and repair costs for equipment and machinery are $1,912.52 annually. Tax and insurance on the feeder pigs totals $223.91 annually.

Comparison of Annual Costs and Returns

Table IX gives the average annual costs and returns for a 100-sow feeder pig production operation. Based on the farrowing, breeding and marketing data in Table II, the average annual total receipts for this operation are $59,306.19.

The average annual total costs of production are $48,351.48. As shown in Table VII, feed cost constitutes $22,289.50 or 46 percent of total cost, while other operating inputs, excluding labor, cost $7,943.88 or 16 percent of total cost. Based on the total pounds of pork sold (including non-breeders, sows after two litters and boars) total production costs are $40.87 per hundred-weight sold. Of this, $18.80 is for feed and $22.07 for the other costs. Total feed costs (including the cost of the feed for the breeding herd) are $31.04 per hundred pounds of feeder pigs sold while the other operating inputs total $11.10 and capital, ownership and labor costs amount to $25.25.

---

[7]Trede, p. 5; Lines and Bache, pp. 14-15; also Owens, Snodgrass, and Lee, pp. 3-14.

The total cost is $67.39 for each hundred pounds of feeder pig sold or $33.69 per feeder. Adjusting total receipts for total operating cost returns to land, labor, capital, machinery, overhead and management are $29,074.81. Reducing this return for a capital cost of $5,769.62, an ownership cost of $7,306.88 and a labor charge of $5,043.59 yields returns to land, overhead, risk and management of $10,954.71 per year.

Finishing Feeder Pigs

The finishing of feeder pigs is the third production process to be presented. This operation involves growing and finishing the feeder pigs to market weight.

Livestock Production

The Production Schedule. Fifty pound feeder pigs are purchased in groups of 240 pigs every eight weeks thus allowing for an average of 6.5 groups per year. A 3 percent death loss, which assumes the pigs die at an average weight of 135 pounds, results in the marketing of 1,511 slaughter hogs annually at an assumed average weight of 220 pounds. Each pig is assumed to spend an average of 17 weeks on the finishing floor.

The slaughter hogs are marketed at an average annual price of $40 per hundred-weight which is seasonally adjusted for the month of sale using the seasonal index in Table III.

Inputs

Building and Equipment Costs. The basic facility is a 20 pen farrowing building as indicated in Table X. This system also includes a

TABLE X

PHYSICAL FACILITIES FOR FINISHING FEEDER PIG SWINE SYSTEM

Item	Description	Size	Initial Investment
Finishing Building	20 pens 8 ft. X 30 ft. on slatted floors with 4 ft. alley way in front of pens.	34' X 160'	$23,500
Lagoon	160 ft. frontage X 115 ft. wide X 10 ft. deep.		2,400
Water System and Generator			3,500
Pickup	1/2 ton		3,500
			$32,900

lagoon for manure disposal, a water system and a one-half ton pickup truck. The initial investment cost of these items of $32,900 assumes the operator acts as his own contractor.

Feed Requirements and Costs. Based on the growing and finishing rations in Table IV, as recommended by Oklahoma State University swine nutritionists,[8] this operation requires 187 tons of grower feed and 315.9 tons of finishing feed. This assumes 3.02 pounds of feed per pound of pork sold and 3.9 pounds of feed per pound gained.

Using the production schedule and the above feed efficiency ratio, the bimonthly ingredient requirements for milo and soybean meal are calculated as shown in Table XI. All other feed ingredients are calculated on a yearly basis. The average annual prices are $4 and $8 per hundred-weight for milo and soybean meal respectively. The price for other feed ingredients is based on prices quoted for the central Oklahoma area in October of 1974. A grinding and mixing charge of $7 per ton of feed is assumed to arrive at total feed costs.

Feeder Pigs Requirements and Costs. As stated previously, fifty pound feeder pigs are purchased in groups of 240 pigs an average of 6.5 times yearly. The price paid for the feeder pigs is determined by a formula based on the market price of slaughter hogs at that time. This price is 1.6 times the market price for the first 40 pounds of pig and market price for any weight greater than 40 pounds. The average annual price of $59.33 per hundred-weight is based on the seasonally adjusted slaughter hog price of $40 per hundred-weight.

---

[8] Stevens and Luce, Swine Nutrition (Stillwater, 1972).

TABLE XI

AVERAGE ANNUAL COSTS AND RETURNS FOR THE FINISHING FEEDER PIGS SWINE SYSTEM

PRODUCTION	UNITS	QUANITY	WEIGHT	PRICE	VALUE/UNIT	VALUE
SLAUGHTER HOGS	HD.	119.00	2.20	40.520	89.14	10608.12
SLAUGHTER HOGS	HD.	232.00	2.20	44.720	98.38	22825.07
SLAUGHTER HOGS	HD.	232.00	2.20	37.880	83.34	19333.94
SLAUGHTER HOGS	HD.	232.00	2.20	41.320	90.90	21089.71
SLAUGHTER HOGS	HD.	232.00	2.20	41.160	90.55	21008.05
SLAUGHTER HOGS	HD.	232.00	2.20	37.320	82.10	19048.11
SLAUGHTER HOGS	HD.	232.00	2.20	37.920	83.42	19354.36
TOTAL RECEIPTS						[illegible]267.19

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PR[illegible]	VALUE
MILO	CWT.	1255.00	1.00	1255.000	3.99	5007.45
MILO	CWT.	1304.00	1.00	1304.000	4.07	5307.28
MILO	CWT.	1381.00	1.00	1381.000	4.03	5565.43
MILO	CWT.	295.00	1.00	1295.000	4.13	5348.35
MILO	CWT.	1378.00	1.00	1378.000	3.93	5415.54
MILO	CWT.	1324.00	1.00	1324.000	3.90	5163.60
SOYBEAN MEAL	CWT.	292.00	1.00	292.000	7.89	2303.88
SOYBEAN MEAL	CWT.	301.00	1.00	301.000	7.92	2383.92
SOYBEAN MEAL	CWT.	313.00	1.00	313.000	7.88	2466.44
SOYBEAN MEAL	CWT.	301.00	1.00	301.000	8.10	2438.1[illegible]
SOYBEAN MEAL	CWT.	324.00	1.00	324.000	8.21	2660.04
SOYBEAN MEAL	CWT.	304.00	1.00	304.000	8.0[illegible]	2432.00
SALT	CWT.	48.00	1.00	48.000	2.10	100.80
DICAL PHOSPHATE	CWT.	144.00	1.00	144.000	3.10	446.40
CALCIUM	CWT.	72.00	1.00	72.000	1.80	129.60
VIT TRACE	CWT.	6.00	1.00	6.000	50.00	300.00
FEEDER PIGS	CWT.	0.50	120.00	60.000	59.97	3598.20
FEEDER PIGS	CWT.	0.50	240.00	120.000	66.18	7941.60
FEEDER PIGS	CWT.	0.50	240.00	120.000	56.06	6727.20
FEEDER PIGS	CWT.	0.50	240.00	120.000	61.15	7338.00
FEEDER PIGS	CWT.	0.50	240.00	120.000	60.[illegible]	7310.39
FEEDER PIGS	CWT.	0.50	240.00	120.000	55.[illegible]	6627.60
FEEDER PIGS	CWT.	0.50	240.00	120.000	56.12	6734.40
GRIND & MIX FEED	TONS	501.90	1.00	501.900	7.00	3513.30
SELL & HAULING	HD.	1511.00	1.00	1511.000	1.50	2266.50
VET & MED.	HD.	1560.00	1.00	1560.000	1.00	1560.00
UTILITIES	DOL.	12.00	1.00	12.000	35.00	420.00
OPER. TAX & INS.	DOL.	36927.00	1.00	36927.000	[illegible].0[illegible]	694.23
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						32.42
EQUIPMENT REPAIR						7[illegible].00
TOTAL OPERATING COST						103127.44

RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT	30139.75

CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	47154.871	4715.48
MACHINERY INVESTMENT	0.100	729.275	72.93
EQUIPMENT INVESTMENT	0.100	16049.988	1605.00
TOTAL INTEREST CHARGE			6393.41

RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT	23746.34

OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)		
MACHINERY	DOL.	177.28
EQUIPMENT	DOL.	3722.70
TOTAL OWNERSHIP COST		3899.98

RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT	19846.36

LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	216.000	648.00
LIVESTOCK LABOR	3.000	960.000	2880.00
TOTAL LABOR COST			3528.00

RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT	16318.36

Labor Requirement and Cost. Detailed studies[9] indicate that a finishing operation of this type requires approximately 1,200 hours of labor yearly. Eighty-two percent is livestock labor and 18 percent machinery labor. A wage rate of $3 per hour is assumed.

Other Operating Inputs and Costs. It is assumed that the marketing cost is $1.50 per pig marketed. Veterinary expenses of $1 per feeder pig are charged and utilities average $35 per month. Fuel, lubrication and repair costs for the finishing building and pickup are about $900 per year.

Comparison of Costs and Returns. The 1,511 slaughter hogs produce receipts of $133,267.19 yearly as shown in Table XI. Total average annual costs are $116,948.83. This includes $50,982.13 or 43.5 percent for feed, $46,277.39 or 39.5 percent for feeder pigs and $5,868.40 or 5 percent for the other operating inputs. Capital, ownership and labor costs are $13,821.39 or 12 percent of total cost. As shown in Table VII, this means that feed cost per one hundred pounds of pork sold is $15.30, feeder pig cost per one hundred pounds pork sold is $13.90 and other operating inputs cost $1.76 per hundred pounds of pork sold. Capital, ownership and labor costs constitute $4.10 of every one hundred pounds of pork sold.

Subtracting the total costs from the total receipts results in returns to land, overhead, risk and management of $16,318.36.

On-Farm Feed Processing and Grain Storage

In the previous sections it is assumed that the rations are pro-

---

[9]Trede, p. 5; Lines and Bache, pp. 14-15; also Owens, Snodgrass, and Lee, pp. 3-14.

cessed off the farm at a cost of $7 a ton to the enterprise. This covers the cost of grinding, proportioning, mixing and delivery of the final feed, so any on-farm systems must include these plus storage of ingredients. As is the case with confinement hog facilities, on-farm feed processing is available in many different type systems. The system presented here is what is referred to as a "package feed center".[10] It is used because 1) it displays a high level of technology, 2) it has low labor requirements, thus making it easily adaptable to the labor intensive swine systems, 3) it is designed for expansion of grain storage and 4) reliable investment and operating costs are available.

Processing

This system is a 40 ton package feed center with a 5 horse-power automatic mill that processes feed at a rate of 2 tons per hour. It includes a drive-over dump and 6 inch auger leg, overhead storage (40 tons), distributor, and an add-on building section that houses the premixer and sacked ingredients. The 6 inch auger is used to move ingredients to the overhead bins and to any ground level storage at a rate of 1,000 bushels per hour.

This system also includes two 3,000 bushel grain bins, with unloading augers and a 10 ton soybean meal tank. This entire system completly erected and ready for use has an initial investment cost of $23,500.

Feed Delivery

An automatic pneumatic delivery system that moves the finished

---

[10]The specifications and costs of this "package feed center" were described in personal interviews with Dr. Peter D. Bloome, Extension Agricultural Engineer, Oklahoma State University.

feed from the mill to the buildings of a farrow-to-finish swine operation has an initial investment cost of $3,000. It is assumed that a feed delivery system for other hog operations that employ fewer buildings costs 75 percent as much as the system used in the farrow-to-finish operations.

Additional Grain Storage

Based on the ration requirements in Table V the system as described provides enough storage to meet the milo requirements of the farrow-to-finish system and the finishing of feeder pigs system for a four month period. The storage capacity filled provides enough milo to last the feeder pig producing farm an entire year. Four 3,000 bushel grain bins must be added to the basic system to give a complete years' milo storage capacity for the farrow-to-finish swine system. Three additional bins provide one year milo storage capacity for the farm that finishes feeder pigs. These additional bins are constructed and equipped to handle grain in and out at an initial investment cost of $.60 per bushel capacity.

Operating Requirements and Costs

There are three operating or processing costs for an on-farm feed processing and grain storage system; 1) labor, 2) electricity and 3) repairs. Bloome and Tubbs, at Oklahoma State University, indicate that an automatic package feed center requires one-fifth of an hour of labor per ton of feed processed and that this ton of feed requires $.15 worth of electrical power. It is assumed that maintenance and repairs on this system, over its lifetime, are equal to one-tenth of its initial invest-

ment cost.[11]

Even though vertically integrating on-farm feed processing and grain storage causes an increase in labor, electrical and repair costs, it results in cost reductions in other operating inputs. It eliminates the feed grinding and mixing charge associated with purchasing feed, and it allows more timely buying of the feed ingredients. The entrepreneur is now able to purchase feed ingredients for the year during harvest time when the grain is at its lowest price.

Comparison of Costs and Returns

The coordination of on-farm feed processing and grain storage with the three basic swine systems has no affect on total receipts to these systems. All systems show a reduction in operating cost as on-farm feed processing is added and exhibit further cost reductions as grain storage is incorporated into the system. All vertically coordinated systems, though, have higher capital, ownership and labor costs which, assuming a 10 percent interest rate, more than off-set the reduction in operating costs resulting in decreased returns to land, overhead, risk and management.

The reduction in average annual operating cost as on-farm feed processing is added to the farrow-to-finish system and the finishing operation is $3,916 and $2,970 respectively. Increases in capital, ownership and labor costs, though, of $3,926 for the farrow-to-finish system and $3,865.52 for the finish operation results in average annual returns to land, overhead, risk and managment of $39,162.24 for the

---

[11]Peter D. Bloome and Alan R. Tubbs, On-Farm Feed Processing: Systems, Economics, Financing Circular E-816(Stillwater, September,1972).

farrow-to-finish system and $15,422.88 for the finishing operation. Similar reductions in operating cost and increases in the other costs yield returns of $38,935.07 to a farrow-to-finish operation that processes feed and stores one years feed grain requirement, and $15,330.52 to the finishing operation that processes feed and stores grain. A feeder pig operation that integrates on-farm feed processing and grain storage reduces returns to land, overhead, risk and management from $10,954.71 to $7,759.52. The actual average annual cost and returns budgets are presented in the Appendix.

CHAPTER IV

PLANNING INFORMATION ANALYSIS

The objective of this chapter is to use the theory of Chapter II and the data presented in Chapter III to develop and present planning information for present and potential hog producers. Two basic planning decisions face the hog entrepreneur. First, which output is to be produced and second, what is the best combination of inputs or resources to produce that output. The information presented in this chapter is intended to help hog producers answer these two questions.

One decision making objective or goal of the farmer, though not necessarily the main objective, is the maximization of profit from the input-output combination. The economic profit of an enterprise is the amount by which the value of the output exceeds the value of the inputs used to produce the output. Inputs traditionally are classified into four categories; 1) land, 2) labor, 3) capital and 4) management. The analysis in Chapter III deducts an opportunity cost for the labor and capital resulting in net returns to land, overhead, risk and management. Assuming that the land requirements are similar for all enterprises presented suggests a charge for use of the land would be about the same for each alternative considered. Thus, any difference in net returns for the enterprise represents a difference in the returns to the entrepreneur's management ability. In this framework, then, maximization of returns to land, overhead, risk and management coincides with maximiza-

tion of economic profit and to accomplish one means to accomplish the other. So, to provide returns to management information is in essence the same as providing profit information for the entrepreneur.

The first analysis, then, for the three basic systems and the vertically coordinated systems, is to examine the returns to land, overhead, risk and management and present a static comparison of the profitability of the various enterprises. A comparison of returns for all systems at different interest rates is used to determine the effect differing capital cost have on the profit earned as the systems are vertically integrated.

A dynamic decision making tool used in this study is a monthly cash flow analysis of the basic systems. A monthly cash flow is a comparison of expected or historical receipts and cash expenses for a production period. It provides planning information concerning loan or credit needs and the repayment capacity of a functioning swine system.

Since each system requires differing levels of operating and investment cost, a discounted net present value analysis provides decision making information that accounts for these differences. Thus, the present value of the stream of returns compared with the present value of the investment required for each system provides an estimate of profitability of investment items at some common point in time.

Analysis

Returns to Land, Overhead, Risk and Management

The information on input requirements, production levels, costs and returns developed in the previous chapter are used to evaluate the relative profitability of the three basic enterprises. As indicated in

Table XII the returns to land, overhead, risk and management are greater for the farrow-to-finish operation that purchases feed (over $39,000) than for either the feeder pig systems with average annual returns of close to $11,000 or the finishing of feeder pigs system with returns of over $16,000.

TABLE XII

COMPARISON OF INVESTMENT, CAPITAL AND OWNERSHIP COSTS, AND LABOR REQUIREMENTS

	Farrow to Finish	Feeder Pig Production	Finish Feeder Pigs
Initial Investment Cost	$83,200	$59,000	$32,900
Capital Cost [A/]	$ 4,395	$ 3,104	$ 1,678
Ownership Cost	$10,260	$ 7,306	$ 3,900
Labor Hours	2,400	1,680	1,180
Returns to Land, Overhead, Risk and Management	$39,172	$10,954	$16,318

[A/] Excludes capital cost on annual operating capital and livestock investment.

It is noted that the returns or profit of the farrow-to-finish operation are greater than the combined returns of the two other systems. Since the farrow-to-finish system is in essence a vertically coordinated system formed by combining a system that produces feeder

with a system that finishes feeder pigs this indicates there is an economic advantage to vertically integrating the two production stages.

As stated previously the amount of land is relatively the same for all three systems but the same thing can not be assumed concerning the level of management involved in the three systems. The management of a hog operation involves the combining and handling of the resources to produce the output. Table XII gives evidence as to the dollar value of resources that are managed by the three enterprises. Though the level of resources managed is not in itself a measure of managerial ability, it can be argued, that to an extent the number of decisions required for the production of a product increases as the number or level of resources increases. However, resource level alone cannot be assumed to be index of the management level of an enterprise. Perhaps the amount of time required is a better comparison of the management levels required by each of the alternative methods of producing hogs. Assuming the management input in hog production is to a degree proportional to the amount of labor used suggests net returns for the production of feeder pigs and finishing hogs should be proportional to the amount of labor used by each.

Comparing the hours of labor used by the three systems with the returns to the three systems indicates a discrepancy. The returns to the farrow-to-finish system are the greatest and the amount of labor and capital involved is the greatest, but the returns to the finishing of feeder pigs system, which has the lowest amount of labor and capital, is not the least. Instead, the feeder pig system has the lowest returns. So, even though it is argued that the entrepreneur that produces feeder pigs requires the greater degree of management of the two systems,

feeder pig production and finishing feeder pigs, the feeder pig operation does not receive the majority of the returns.

Since both enterprises employ resources at the most efficient level, the disproportionate returns is due to the prices used, mainly the price of feeder pigs. Increasing the value of feeder pigs results in an increase in returns to the feeder pig production operation and a decrease in returns to the system that finishes feeder pigs. To establish a feeder pig value that results in equitable returns to each operation, it is necessary first to adjust the finishing operation so that it finishes the number of feeder pigs the feeder pig operation produces. This coordination is required so that market hogs finished by the finishing operation represent the feeder pigs produced by the feeder operation.

Table XIII presents a combined average annual budget based on the basic budgets of the previous chapter. This budget is adjusted so that the 1,435 feeder pigs finished by the finishing system equals the 1,435 feeders produced by the feeder pig operation after saving replacement gilts. The operating capital, ownership and labor costs contributed by the feeder pig production system are identical to the basic budget. The operating costs of the basic finishing operation and the receipts are adjusted according to the slight reduction in feeder pigs finished. Returns to land, overhead, risk and management of the two systems total $25,997.

Table XII shows that the feeder pig operation requires 1,680 hours of labor annually and the finishing operation 1,180 hours. Mathematically equating the ratio of labor to the ratio of net returns results in equation 1.

TABLE XIII

AVERAGE ANNUAL COSTS AND RETURNS FOR A COMBINED, FEEDER PIG PRODUCTION - FINISHING OF FEEDER PIGS, SYSTEM

Production		
Slaughter Hogs	$122,770	
Breed Herd	16,735	
TOTAL RECEIPTS		$139,505
Operating Inputs Cost		
Feeder Pig Production	30,231	
Finish Feeders[A/]	53,724	
TOTAL		83,955
Capital Cost		
Feeder Pig Production	5,769	
Finish Feeder[A/]	4,007	
TOTAL		9,776
Ownership Cost		
Feeder Pig Production	7,306	
Finish Feeder	3,900	
TOTAL		11,206
Labor Cost		
Feeder Pig Production	5,043	
Finish Feeders	3,528	
TOTAL		8,571
Returns to Land, Overhead, Risk and Management of Combined System		25,997

[A/] Does not include cost of feeder pigs.

$$(1)\quad \frac{FP\ (P_{FP}) + Sows\ (P_{SH'}) - Feed\ Cost - V.C. - F.C.}{SH\ (P_{SH}) - Feed\ Cost - V.C. - F.C.} = \frac{1680\ hr.}{1180\ hr.}$$

where:

FP = Hundred weights of feeder pigs produced by feeder pig operation,

P_{FP} = Price of feeder pigs per hundred-weight,

Sows = Hundred-weights of sows and boars sold,

V.C. = Cost of operating inputs, excluding feed,

F.C. = Capital and ownership costs,

SH = Hundred-weights of slaughter hogs produced by finishing operation,

P_{SH} = Price of slaughter hogs per hundred-weight,

$P_{SH'}$ = Price of sows and boars per hundred-weight (adjusted slaughter hog price).

Substituting the costs of inputs as presented in Table XIII and the level of outputs yields equation 2,

$$(2)\quad P_{FP} = 2.25\ (P_{SH}) - 24.4$$

the linear relationship of feeder pig prices and slaughter hog prices that results in equitable returns for the two systems. With a market price of slaughter hogs of $40 per hundred-weight the price of feeder pigs is $65.60 per hundred-weight. Figure 5 presents the graphical relationship of equation 2.

Generally though, feeder pigs are not priced using the type of formula in equation 2. Usually they are priced on a per head basis. This is calculated as a factor value times the slaughter hog price for the first forty pounds of feeder and slaughter price for the remaining weight. Converting this per head pricing method to a per hundred-weight formula results in equation 3.

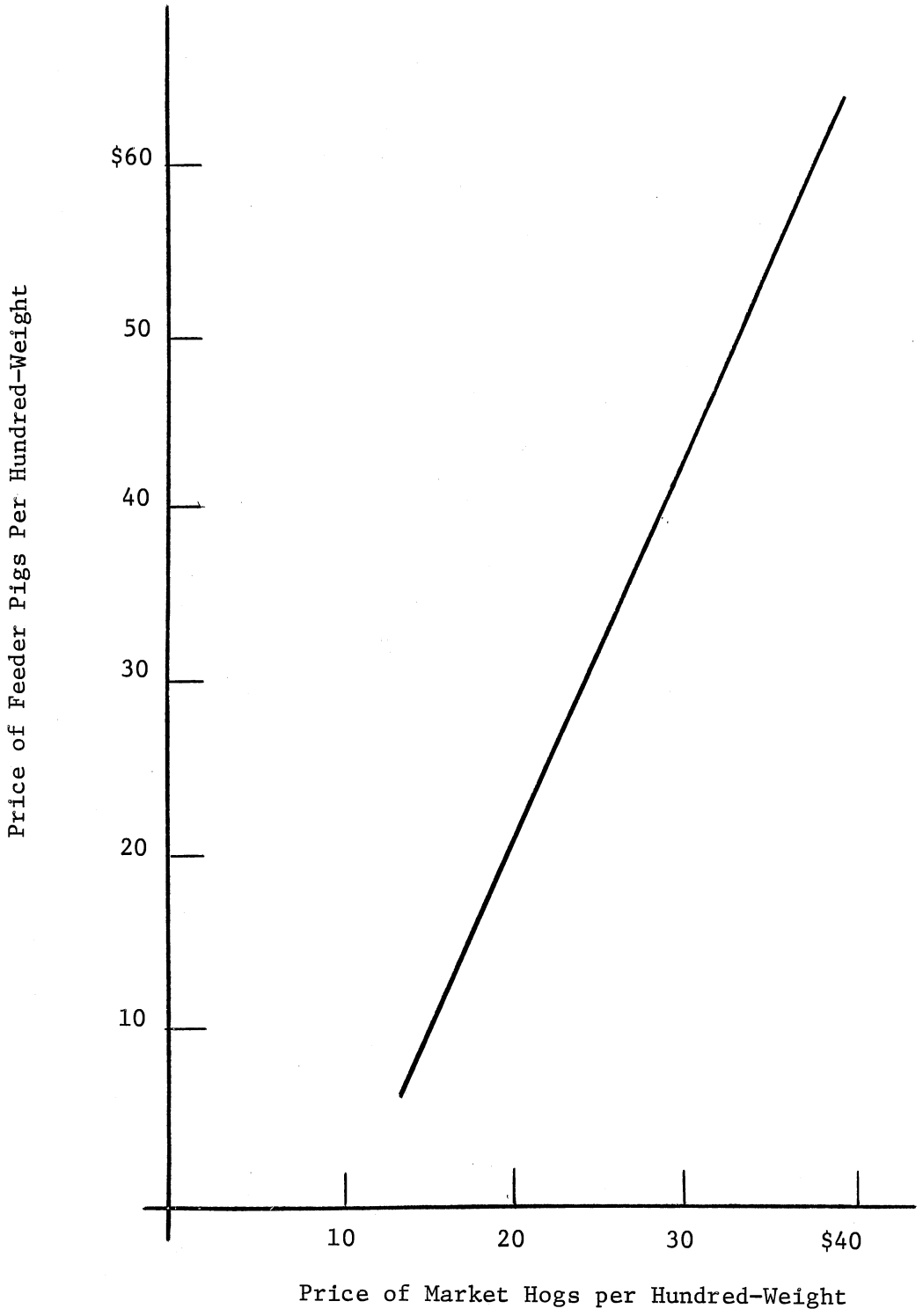

Figure 5. Price Relationship to Yield Equitable Returns to Feeder Pig and Finishing Operations

(3) $P_{FP} = (.80F + .20)\ P_{SH}$

where:

P_{FP} = Per hundred-weight price of feeder pigs,

F = A factor value,

P_{SH} = Per hundred-weight price of slaughter hogs.

Setting equations 2 and 3 equal to each other and solving for the factor F results in equation 4.

(4) $F = 2.5625 - \frac{30.5}{P_{SH}}$

This yields the factor for equation 3 that results in equitable returns for the two systems at various slaughter hog prices. Figure 6 presents the graphical relationship between slaughter hog price and the equitable factor that yields the proper feeder pig value.

Assuming $40 per hundred-weight price of hogs, equation 4 indicates that the factor of 1.8 is required in the standard formula to yield equitable returns to the two systems. This factor results in a price of $65.60 per hundred-weight for feeder pigs. Generating new budgets, based on this new feeder price, for the feeder pig operation and the finishing operation result in returns of $15,565 and $11,098 respectively. The returns to the two systems are, thus, of the same proportion as the labor requirements.

It is evident then that this pricing formula provides feeder prices for a wide range of slaughter hog prices. This system of formulating feeder pig prices also allows the inclusion of variation in other important factors such as feed prices, feed efficiency and the number of pigs produced.

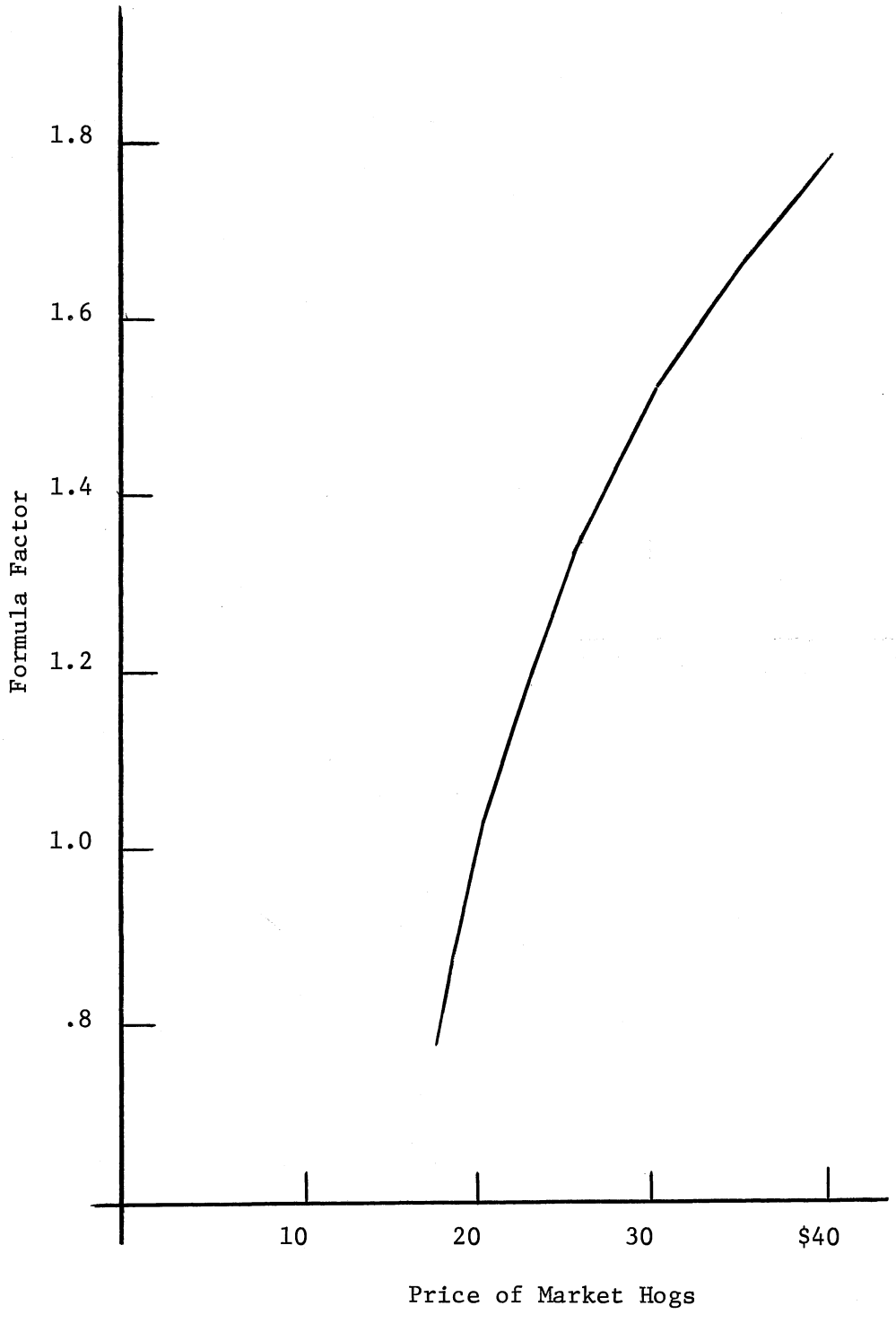

Figure 6. Relationship of Factor Value and Slaughter Hog Price to Yield Equitable Net Returns

Dynamic Cash Flow

A dynamic monthly cash flow analysis provides an evaluation of a swine system over a period time. It results in an actual display of expected cash receipts, cash expenses, and returns of a hypothetical functioning system. This yields planning information for a particular system in terms of its financial needs for the future, and a dynamic comparison of systems with regard to maximum credit needs and loan repayment time.

A monthly cash flow is either projected for the future based on experimental data or is a mapping of receipts and expenses for historical data. In either case the calculation is essentially as follows:

Cash Balance Beginning of the Month
+ Cash Receipts (operating and/or capital sales)
- Cash Expenditures (operating and/or capital expenses)
= Current Cash Balance
+ Money Borrowed this Month
- Loan Interest Payments
- Loan Principle Payments
= Cash Balance End of Month

A positive current balance indicates money available for loan repayment or, if no loan exists, monthly income for a cash balance. A negative current balance means additional funds are borrowed to meet unpaid expenses. Accumulated borrowing, that fluctuates as money is borrowed and repaid, reflects a loan balance of outstanding debts, and

is the basis for the monthly interest calculation.[1]

Since this study employs experimental data for a hypothetical swine operation, the cash flow analysis used is a projected monthly cash flow. It assumes that the hog farmer begins construction of the system at the beginning of the year, with construction time for facilities as given in Table XIV. The building schedule and the purchase of other inputs is coordinated so that buildings are utilized shortly after construction of each is completed.

TABLE XIV

CONSTRUCTION TIME NEEDED ASSUMING THE OPERATOR ACTS AS GENERAL CONTRACTOR[A/]

Facility	Time
Farrowing - Growing Building[B/]	4 months
Finishing Building	2 months
Breed Herd Housing	2 months

[A/] Construction of lagoon hired-out

[B/] Farrowing and growing facilities are built as one structure

[1] Allan R. Tubbs and Kenneth N. Wegenhoft, Cash Flow Planning: Why? (Stillwater, 1973); also Allan R. Tubbs and Kenneth N. Wegenhoft, Cash Flow Planning: How? (Stillwater, 1971).

To calculate the amount of investment and operating capital required for each system, the projected monthly cash flow assumes all money is borrowed on a demand note as needed at a 10 percent interest rate. Each investment and operating capital item is paid for when completed or purchased. The entrepreneur's labor required to supervise construction is not included as a cost, since it is a function of his managerial ability as to how much time is involved.

Farrow-to-Finish. The first analysis deals with the projected cash flow of the 100-sow farrow-to-finish system. The receipts and expenses are based on the farrow-to-finish system that purchases feed presented in the previous chapter. The monthly cash flow for the first year of operation is presented in Table XV.

Construction starts with the lagoon and the pens for the breeding herd. The lagoon is the first item completed and it is paid for during the first month (January). Some feed for the gilts and boars is to be purchased the second month. Total expense during January is $3,163. Since there are no cash receipts, the current balance is -$3,163 and the accumulated balance is also -$3,163. A loan is taken out for $3,163 making the ending cash balance for January zero.

During February the pens for the breeding stock are completed and the first breeding animals (34 sows and 5 boars) are purchased. The cost of these investment items ($12,900) is added to the accumulated balance. The $26 interest that accrued on the January loan balance is added resulting in a loan balance at the end of February of $16,089.

The farrower-grower is built during the March through June period. The only new investment during March is for the tractor, feed trailer and pickup truck. The first labor expense withdrawal is shown in March.

TABLE XV

YEAR ONE, PROJECTED CASH FLOW FOR THE 100-SOW FARROW-TO-FINISH SWINE SYSTEM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Income													
Sl Hog	0	0	0	0	0	0	0	0	0	0	0	17246	17246
Sows	0	0	0	0	0	333	0	333	0	333	0	0	999
Boars	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Income	0	0	0	0	0	333	0	333	0	333	0	17246	18245
Expense													
Labor	0	0	300	300	300	300	600	600	600	600	600	600	4800
Feed	700	0	700	0	700	0	2130	0	6213	0	10240	0	20683
Mix Feed	63	0	63	0	63	0	151	0	454	0	756	0	1550
Mkt. Exp.	0	0	0	0	0	0	0	0	0	0	0	311	311
Repairs	0	0	0	0	0	0	0	0	190	190	190	190	760
Utilities	0	0	0	0	0	0	0	0	106	106	106	106	424
Fuel	0	0	0	0	0	0	0	0	17	18	17	18	70
Vet.	0	0	0	0	0	0	0	0	441	0	441	0	882
Ins. & Tax	0	0	0	0	0	0	519	0	0	0	0	0	519
Breed Herd	0	4900	0	3300	0	3700	0	300	0	300	0	0	12500
Bldgs. &Mach.	2400	8000	5800	3500	0	40000	0	23500	0	0	0	0	83200
Total Expense	3163	12900	6863	7100	1063	44000	3400	24400	8021	1214	12350	1225	125699
Current Balanc	-3163	-12900	-6863	-7100	-1063	-43667	-3400	-24067	-8021	-881	-12350	16021	-107454
Accum. Balance	-3163	-16063	-22926	-30026	-31089	-74756	-78156	-102223	-101244	-111125	-123475	-107454	-107454
Bank Balance	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest	0	26	134	192	253	264	630	664	870	944	959	1070	6007
Loan Balance	3163	16089	23086	30379	31695	75626	79656	104387	113278	115103	128412	113461	113461

The loan balance at the end of the third month is $23,086.

During April the second group of 33 gilts is purchased and the water system and generator paid for. No new investments are made in May.

The first cash receipts, sale of nonbreeders from the first group of gilts bred, occurs in June. The third group of gilts is purchased in June and the farrower-grower building completed. The first group of pigs is also farrowed in June. The loan balance at the end of June increases to $75,626.

The finishing building, the last part of the facilities to be built, is constructed during July and August. It is paid for during August. The loan balance at the end of August is $104,387. This increases gradually through November to pay for feed and other operating inputs required.

Pigs from the first farrowing are marketed in December. The December current balance of $16,021 is applied to payment of interest and the loan balance. This leaves the operator with a loan balance at the end of the first year of $113,461.

No additional investments in buildings and equipment are made during the second year. The cash receipts during the year from the sale of slaughter hogs, non-breeders, sows and boars total $138,945. Cash expenses for operating inputs, insurance, taxes, and the purchase of five new boars, total $85,644. Each month that a positive current balance occurs, it is applied to reduce the loan balance. The loan balance increases to a high of $119,947 at the end of January and then declines to $69,985 at the end of the second year.

The cash flow is projected through the third and fourth years to

estimate the amount of time required to retire the loan. The loan balance decreases from $69,985 at the end of the second year to $18,522 at the end of the third year, a reduction of $51,463. The loan balance is retired in June of the fourth year and a cash balance established. The cash balance increases to $34,996 at the end of year four.

Based on the demand note financial plan the projected cash flow for the 100-sow farrow-to-finish system requires a maximum loan of approximately $128,500 in the eleventh month of operation. Assuming the withdrawal of $4,800 the first year and $7,200 per year thereafter for hired labor or living expense, the system generates enough income to retire the loan in 3 1/2 years (42 months), as indicated in Table XVI under the heading "Base Run".

The 100-sow farrow-to-finish operation, as presented in Chapter III, is based on several factors that are directly affected by management ability and economic conditions. A variation in any of these factors affects the monthly cash flow for the system. Four of these factors are altered individually as a means of providing planning information that better suits varied management and economic conditions. The four factors considered are an increased feed conversion rate, a reduction in the number of pigs produced per litter, a higher price for feed and lower price for slaughter hogs.

The basic annual cost and returns information assumes an overall feed efficiency of 3.6 pounds of feed per pound of pork sold. Should the management level and physical conditions prevail such that the actual feed efficiency is 4.0 pounds of feed per pound of pork sold for this system, then a resulting projected cash flow yields results different from the basic cash flow. The effect is to increase the amount

TABLE XVI

THE EFFECT OF MAJOR FACTORS ON THE MAXIMUM LOAN BALANCE AND THE TIME REQUIRED TO RETIRE THE LOAN FOR A 100-SOW FARROW-TO-FINISH OPERATION

Type of Cash Flow	Feed Efficiency	Pigs Per Litter	Price of Feed		Price Market Hogs	Maximum Loan		Loan Retired		
			Milo	Soybeans		Month	Amount	Year	Month	Ending Cash Balance[A/]
Base Run	3.6	8	$4.00	$8.00	$40	11	$128,412	4	42	$34,996
Reduced Feed Efficiency	4.0	8	4.00	8.00	40	11	130,895	4	48	6,965
Reduced Pigs Per Litter	3.6	7	4.00	8.00	40	11	125,976	4	48	1,211
Increased Feed Price	3.6	8	5.00	10.00	40	11	133,663	5	54	14,449
Reduced Hog Price	3.6	8	4.00	8.00	38	11	128,463	4	48	10,167

[A/] Ending cash balance of the year loan retired.

of feed required, increase the accumulated loan balance and to lengthen the time required to repay the loan. An additional 71.5 tons of feed are required yearly, increasing the maximum loan to $130,895 during November of the first year. The loan is not retired until December of the fourth year.

A reduction in the pigs per litter from 8 to 7 reduces the operating costs of feed, marketing, veterinary, insurance, and taxes, but it also reduces income generated by the system since the average annual number of slaughter hogs sold is reduced by 195 head. The result, compared to the base run, is to reduce the maximum loan required to approximately $126,000, but to lengthen repayment time to December of the fourth year. The bank balance at the end of four years is $1,211.

Since feed cost makes up a large amount of operating expenses, any increase in the price of the rations results in a substantial change in the projected cash flow. Assuming that the price of milo ($4 per hundred-weight) and soybean meal ($8 per hundred-weight) increases by 25 percent, which means $5 milo and $10 soybean meal, then the maximum loan balance is $133,663 or over $5,000 more than the basic run. Of equal importance, the loan is not retired until June of the fifth year, fifty-four months after the system is started.

The basic run assumes the price of slaughter hogs as $40 per hundred-weight. A $2 per hundred-weight decrease in the price of hogs causes a yearly decrease in income of approximately 5 percent. This has very little effect on the maximum loan but increases the length of time needed to repay the loan to December of the fourth year.

Feeder Pig Production. The projected monthly cash flow for the 100-sow feeder pig producing system is based on the system that pur-

chases its feed as presented in Chapter III and sells at an equitable feeder pig price. The construction schedule of the facilities is the same as the farrow-to-finish operation, except that there is no finishing house built since the feeder pigs are sold off the growing floor.

The buildings and machinery investment items valued at $59,700 are all completed and paid for by the end of the sixth month. The breeding herd is purchased during February, April and June. The loan balance at the end of June, when the first group of sows farrow, is $75,472.

The first sale of feeder pigs for $2,789 in September is based on the pricing formula of 1.8 times market price for the first 40 pounds of feeder pig and market price for the remaining weight. Operating expenses of $4,809 for the month result in an increase in the loan balance to $85,236. October has the first positive current balance ($2,968) but a negative current balance in November results in an $85,888 loan balance, the maximum loan balance for this operation as shown in Table XVII.

Total income exceeds cash expenses by $28,146 in the second year, and by $22,089 in the third year resulting in an estimated loan balance of $46,261 at the end of year three. The loan is still not retired at the end of four years with $16,543 still due on the loan.

Projecting the cash flow through the fifth year results in the retirement of the loan in June, the fifty-fourth month of operation. A cash balance of $4,881 is estimated for the end of the fifth year.

Four basic assumptions, 8 pigs per litter, feed ingredient prices, pricing formula and $40 slaughter hogs, are altered to determine their effect on maximum loan size and length of the loan.

As indicated in Table XVII, a reduction in the pigs per litter from

TABLE XVII

THE EFFECT OF MAJOR FACTORS ON THE MAXIMUM LOAN BALANCE AND THE TIME REQUIRED TO RETIRE THE LOAN FOR A 100-SOW FEEDER PIG PRODUCING OPERATION

Type of Cash Flow	Pigs Per Litter	Price of Feed		Price Market Hogs	Maximum Loan		Loan Retired		
		Milo	Soybeans		Month	Amount	Year	Month	Ending Cash Balance[A/]
Base Run (1.8 Formula Factor)	8	$4.00	$8.00	$40	11	$85,888	5	54	$4,881
Reduced Pigs Per Litter	7	4.00	8.00	40	14	86,914	7	76	11,871
Increased Feed Price	8	5.00	10.00	40	11	89,105	7	76	12,613
Reduced Hog Price	8	4.00	8.00	38	11	86,394	6	67	13,122
Price Formula Factor of 1.6	8	4.00	8.00	40	11	86,797	6	72	1,635

[A/] Ending cash balance of the year loan retired.

8 to 7 increases the maximum loan to $86,914 during February of the second year. Assuming a demand note loan financial arrangement means that the loan is not retired until the seventh year or seventy-sixth month of operation. Similar results are found assuming a 25 percent increase in the price of feed. The maximum loan is increased by nearly $4,000 and the loan is not retired until the seventh year of operation.

Since feeder pigs are sold at a formula price based on the price of slaughter hogs, any change in the price of market hogs changes the price of feeder pigs. Assuming a market hog price of $38 per hundredweight means that the system generates enough income to repay the loan during the sixth year of operation, with a small increase in the size of the maximum loan.

The price formula also affects the projected cash flow, since any change in it changes the price received for feeder pigs. The previous cash flows assume a price of feeder pigs of 1.8 times market price for the first forty pounds of feeder pig and market price for remaining pounds. Changing the 1.8 factor to 1.6 means a decrease in receipts to the producer resulting in an increase in the time needed to repay the loan. The maximum loan of $86,797 is still realized in the eleventh month of operation, but the loan is not retired until December of the sixth year, an increase of 1 1/2 years over the base run.

Finish Feeder Pigs. The next projected monthly cash flow is for the feeder pig finishing operation with feeder pigs purchased in groups of 240 pigs every eight weeks and finished on purchased feed. The construction schedule is based on the information in Table XIV. The lagoon, water system and finishing building are completed and paid for ($32,900) during the first three months of operation. The first group

of feeder pigs is purchased in April, resulting in cash receipts of $10,506 in August. The accumulation of cash expenses results in a maximum loan of $82,359 in January of the second year. The loan, as shown in Table XVIII, is retired during December of the fifth year, fifty-nine months after the system is started.

The price that is paid for feed has a profound effect on the projected cash flow. Five dollars per hundred-weight milo and $10 hundred-weight soybean meal causes an estimated maximum loan during the first seven years of $95,181 in May of the second year, but the loan is not retired in the seven-year period. The remaining loan balance, as indicated in Table XVIII, is $76,608 after seven years of operation.

Any change in the price of slaughter hogs affects both the receipts and cash expenses (feeder pigs purchased) of the system. Thus, it is necessary to evaluate the effect of both an increase and a decrease in the price of market hogs has on the projected cash flow. Assuming an average market price of hogs of $42 per hundred-weight results in an estimated $585 reduction in the maximum loan and reduces the length of time needed to repay the loan to 53 months. At the end of five years a cash balance of $21,503 is accumulated. A decrease in the market price of slaughter hogs results in an increase in the maximum loan and extends the loan repayment time to December of the seventh year.

Net Discounted Present Value

The comparison of average annual returns and the projected cash flows provides respectively a static and dynamic measure of the profitability of the enterprise, but neither approach compares all costs and returns at the same point in time. Operating capital items such as

TABLE XVIII

THE EFFECT OF MAJOR FACTORS ON THE MAXIMUM LOAN BALANCE AND THE TIME REQUIRED TO RETIRE THE LOAN FOR A FINISHING OF FEEDER PIG OPERATION

Type of Cash Flow	Price of Feed		Price Market Hogs	Maximum Loan		Loan Retired		
	Milo	Soybeans		Month	Amount	Year	Month	Ending Cash Balance[A]
Base Run	$4.00	$8.00	$40	13	$82,359	5	59	$ 630
Increased Feed Price	5.00	10.00	40	17	95,181	-	--	(76,608)[B]
Increased Price of Hogs	4.00	8.00	42	13	81,774	5	53	21,503
Reduced Price of Hogs	4.00	8.00	38	13	82,943	7	84	9,748

[A] Ending cash balance of the year loan retired.

[B] The loan balance remaining after 7 years.

feed, marketing services and veterinary inputs are purchased and used within a short time period, usually within a year. These items are, thus, quickly transformed into receipts. Capital investment items such as buildings and equipment are purchased and used over a long period of time. For this reason the cost of investment items affects the swine systems operation for a long time. Thus, it is necessary to consider the effect of time in comparing the profitability of the alternative production systems.

The net discounted present value analysis is a capital budgeting technique used to compare alternative investments. This technique, as used in this study, establishes the present value of the expected returns that accrue to an investment over its lifetime and then compares this total to the present value of the investment. The amount, if any, by which returns to the investment exceeds the investment cost is the amount of profit earned by the investment.

To arrive at the present value of returns, it is necessary to project cash income and cash operating expenses for the life of the system. For the three basic systems, it is assumed that their functional life is eight years and any production after eight years is assumed to require new investment. Because of this, and the fact that any returns after eight years discounted (assuming a 10 percent interest rate) to year one are of relatively little value, income and expenses are needed for eight years of each operation. Projected monthly cash receipts and expenses are available in the cash flow analysis, as shown in Table XV. Discounting year one first, the month of January shows a -$3,163 current balance. This reduced by the investment cost of $2,400 leaves -$763 of returns to investment on January, 31. This return is discounted to day

one using equation 1,

$$(1) \quad \text{Present Value of Returns or Investment Cost} = \frac{\text{Monthly Returns or Investment Cost}}{(1 + .0083)^n}$$

with n as the numerical month within which the returns are earned (January as 1, ... December as 12). The investment cost of $2,400 is also discounted using equation 1 to arrive at the present value of the investment (all of which takes place in the first year). This monthly process is continued for the remaining months of year one and the values summed to arrive at the present value for year one. The monthly receipts and expenses for years two through eight are then computed as the average of the monthly current balance of years two, three and four of the cash flow results. The average monthly returns are then discounted, using equation 1, to yield the value of each year's returns on January 1 of that year. Then, still assuming a 10 percent interest rate, the January 1 year one present value of returns to investment is calculated using equation 2,

$$(2) \quad \text{Present Value of Returns} = \frac{\text{Jan. 1 Yearly Returns}}{(1 + .10)^{n-1}}$$

with n being the year of operation.[1] The present value of yearly returns are then summed along with the present value of the salvage value of the investment to arrive at the total present value of returns to investment as shown in Table XIX.

The farrow-to-finish operation shows a net discounted present value of $152,262 returns to the initial investment cost. This is interpreted as the marginal profit the system is estimated to earn above

---

[1] Baumol, pp. 446-448.

TABLE XIX

NET DISCOUNTED PRESENT VALUE OF ALTERNATIVE SWINE INVESTMENTS
ASSUMING A TEN PERCENT INTEREST RATE

System	Total Returns[A] to Investment	Present Value of [A] Returns to Investment	Present Value of Investment Cost	Net Present Value of Investment
100-Sow Farrow-to-Finish	$367,356	$231,605	$79,343	$152,262
100-Sow Feeder Pig Production	182,666	112,853	57,351	55,502
Finish Feeder Pigs	110,402	60,686	32,436	28,250

[A] Includes salvage value of buildings, equipment and machinery.

the initial cost of investment capital. Comparatively the feeder pig producing system projects a net discounted present value of $55,502 for returns to the investment, and the finishing operation projects a net value of $28,250. Thus, all systems, with returns and costs discounted to day one of operation, have the potential of returning a profit to their respective investment with the farrow-to-finish having the largest returns and the finishing the least.

Input Combination Analysis

The analysis thus far has dealt with the comparison of alternative swine operations (farrow-to-finish, feeder pig production, and finishing feeder pigs) that are assumed to illustrate the most efficient resource combinations for producing hogs. As noted previously on-farm feed processing and on-farm grain storage are likely production stages to be vertically integrated with either system to provide alternative resource combinations.

Returns to Land, Overhead, Risk and Management

The basic means by which to evaluate on-farm feed processing and grain storage is the amount that each adds to or subtracts from per unit cost of producing the output. Since these production alternatives have no affect on the level of output, any change that occurs in the profit earned by the system when either is added indicates a change in the per unit cost of production.

Referring to Table XX, it is evident what affect on-farm feed processing and on-farm feed processing grain storage have on the alternative systems. The 100-sow farrow-to-finish operation that purchases

feed has average annual returns to land, overhead, risk and management of $39,172, based on the average annual total receipts of $143,302. Assuming a 10 percent interest rate, this same output produced by a 100-sow farrow-to-finish operation that processes its own feed returns $39,162. This indicates that the reduction in operation cost due to processing the feed on the farm is not significantly less than the increase in costs due to the higher investment and labor costs. The 100-sow farrow-to-finish operation that processes feed and stores a years' grain requirements returns $237 less than the operation that purchases feed. Thus, the per unit production costs, assuming a 10 percent interest rate, of the system that purchases feed and the system that processes the feed are almost identical, while the operation that processes feed and stores grain exhibits per unit costs somewhat higher than the other two.

TABLE XX

COMPARISON OF RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT OF VARIOUS SWINE PRODUCTION PROCESSES[A/]

Input Combination	Farrow to Finish	Feeder Pig Production	Finish Feeder Pigs
Purchase Feed	$39,172	$15,565	$11,098
Process Feed	39,162	12,370	10,203
Store Grain	38,935	------	10,115

[A/] Assuming a 10 percent rate.

The average annual returns to the feeder pig operation and the system that finishes feeder pigs are highest when feed is purchased, exceeding the other alternative resource combinations by at least $800. The returns to the finishing operation that processes feed and the operation that processes feed and stores grain differ by only $88, which indicates that their per unit cost of production are about the same.

Capital Cost

The capital cost of a hog enterprise is the charge for using operating and investment capital in the enterprise. If it is an actual charge, it represents the cost of money borrowed to purchase the inputs. If it is an opportunity charge, it refers to the return the money spent could have earned in an alternative use that is thus foregone. In either case the interest rate used is usually the rate at which financial institutions are loaning money. In actuality interest rates are constantly changing and are not the same for all individuals. So, in production systems such as these that require large amounts of capital any difference or change in the interest rate changes the profitability of the enterprise.

The analysis now looks at the effect interest rates have on the returns earned by the alternative production processes. Up to this point all analysises assumed a 10 percent interest rate. Table XXI shows the effect reducing interest rates to 7 1/2 percent and 5 percent has on the returns earned.

The 100-sow farrow-to-finish operation that purchases feed and the system that processes feed are about $200 more profitable than the 100-sow farrow-to-finish operation that processes feed and stores grain,

TABLE XXI

THE EFFECT OF INTEREST RATE ON THE RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT FOR ALTERNATIVE SWINE PRODUCTION PROCESSES

Process	Interest Rate		
	10%	7 1/2%	5%
Farrow-to-Finish			
Purchase Feed	$39,172	$41,524	$43,876
Feed Processing	39,162	41,735	44,308
Grain Storage	38,935	41,668	44,401
Feeder Pig Production			
Purchase Feed	15,565	17,008	18,450
Feed Processing	12,370	14,157	15,945
Finish Feeder Pigs			
Purchase Feed	11,098	12,748	14,399
Feed Processing	10,203	12,096	13,989
Grain Storage	10,114	12,124	14,134

assuming a 10 percent interest rate. This is because at the higher interest rate the additional investments of the latter system causes a higher capital cost that is not offset by the reduced operating cost. At lower interest rates the opposite effect is evident. At an interest rate of 7 1/2 percent the feed processing system shows the highest returns and the feed purchasing the lowest. The reduced charge for capital now makes the reduction in operating costs, that results from the processing of feed on the farm, yield a higher profit to the system that employs more capital investment items. So with a reduction in the interest rate from 10 to 7 1/2 percent there is a lowering of the per unit total cost of production for all systems but a relatively greater reduction for the system that processes feed. A reduction in the interest to 5 percent again lowers per unit production costs for all systems, making them more profitable. Relatively, the costs for the system that uses the highest level of investment capital, the system that stores the grain, are reduced the most.

At a 10 percent interest rate the feeder pig producing system that purchases feed is substantially more profitable than the system that processes feed on the farm and stores grain. By reducing the interest rate to 7 1/2 and 5 percent both become more profitable but the feed purchasing operation remains substantially more profitable. Thus, at none of the interest rates examined does the decrease in operating costs from on-farm feed processing and grain storage offset the increase in capital cost that results from the increase in the investment level. The same is true for the alternative finishing operations. However, at the 5 percent rate the range of the returns is only $410 which indicates that at lower interest rates returns to the systems may be relatively

the same.

Net Discounted Present Value

The average annual returns earned by the various systems are the amount by which average income exceeds average cost. With investment items this is not a true comparison since the cost of the durable inputs purchased now is not directly comparable to the receipts earned in later years from the investment inputs. So, to compare different investment combinations that produce differing flows of receipts it is necessary to determine the net discounted present value of the return to investment earned by the alternative systems. Table XXII presents the net present value of the returns that accrue to the investment in the various systems.

As on-farm feed processing and on-farm grain storage are added to the farrow-to-finish system, the reduction in the cash operating expenses results in increasing total returns to the investments from $367,356 to $410,839. Discounting the returns to the first day of operation results also in increasing present value of returns as the system is vertically integrated. As to be expected, the increase in investment cost leads to higher present values of investment costs. The result, as implied by the net present value of the systems, is that even though there is a reduction in cash operating costs that results in increased returns over the life of the systems, the additional investment costs of vertical integration more than offset this causing the marginal returns to investment to decrease from $152,262 for the system that purchases feed to $146,375 for the system that processes feed. Comparing the addition of grain storage to a system that processes feed

TABLE XXII

NET DISCOUNTED PRESENT VALUE OF ALTERNATIVE INPUT COMBINATIONS FOR SWINE OPERATIONS ASSUMING A TEN PERCENT INTEREST RATE

System	Total Returns[A] to Investment	Present Value[A] Returns to Investment	Present Value of Investment Cost	Net Present Value of Investment
Farrow-to-Finish				
Purchase Feed	$367,356	$231,605	$ 79,343	$152,262
Feed Processing	402,609	250,882	104,915	145,967
Grain Storage	410,839	256,372	109,997	146,375
Feeder Pig Production				
Purchase Feed	182,666	112,853	57,351	55,502
Feed Processing	193,635	118,702	82,923	35,779
Finish Feeder Pigs				
Purchase Feed	110,402	60,686	32,436	28,250
Feed Processing	133,840	76,054	58,008	18,046
Grain Storage	146,371	82,619	63,319	19,300

[A] Includes salvage value of buildings, equipment and machinery.

indicates that the resulting increase in returns makes grain storage a profitable investment.

The results are the same for the feeder pig system that adds feed processing and grain storage. The additional investment cost is greater than the value of future returns. Also, with the system that finishes feeders the additional investment of vertical integration is greater than the resulting increase in returns to the investment.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter is comprised of three parts: summary, results, and areas for further research. The summary restates the objectives of this study and describes the approach used to meet the objectives. The results draw some conclusions about confinement swine systems in Oklahoma. The last section of the chapter develops, based on the objectives and conclusions, areas or hypothesis that require further study.

Summary

The overall objective of this study, as described in Chapter I, is to provide planning information for present and potential commercial, confinement swine producers in Oklahoma. Specifically the first objective was to establish input-output information for three basic confinement systems, the farrow-to-finish operation, the feeder pig producing system and the system that finishes feeder pigs. To do this, budgets were generated for each system based on resource requirements and output estimates of animal scientists and agricultural engineers at Oklahoma State University. Each system was generated assuming above average management employing the latest level of technology. Chapter III presents the input-output information in the form of average annual costs and returns budgets for a 100-sow farrow-to-finish system, a 100-sow feeder pig operation and a finishing system that produces an average of

more than 1,500 slaughter hogs annually. Input information is also presented and budgets generated for the three systems vertically integrated with on-farm feed processing and on-farm grain storage.

The next step to provide decision making information was a comparison of the returns to land, overhead, risk and management of the various enterprises at various interest rates. This static approach to profitability yielded information that can be used to decide which output to produce and how to combine inputs to produce the output. During the course of comparing the returns to the swine systems, it became evident that information was needed to determine the value of feeder pigs produced and sold. Chapter IV presents a means of pricing feeder pigs, based on the price of slaughter hogs, so that the returns to the feeder pig producer and the finishing operation compare to the labor required by each system.

Another objective of this study was to develop a projected monthly cash flow for the various systems. The cash flow analysis in Chapter IV provides planning information concerning loan levels and repayment capacity for the three systems under varied management factors and economic conditions.

Since each system requires different levels of investment and operating capital, a net discounted present value budgeting technique was used to compare the profitability of the various investments. This provides comparative planning information with regard to the net returns that each system can be expected to earn at a common point in time.

Results

Farrow-to-Finish

Based on the experimental data used, to generate the budget for the 100-sow farrow-to-finish operation, this operation produces an average of 1,435 slaughter hogs annually. As indicated in Table XXIII annual gross receipts from the sale of market hogs, sows and boars total yearly about $143,000, assuming an average price of $40 per hundred-weight for the 220 pound barrows and gilts.

TABLE XXIII

SUMMARY OF THE AVERAGE ANNUAL COSTS AND RETURNS BUDGET FOR BASIC CONFINEMENT SWINE SYSTEMS[A/]

	100-Sow Farrow to Finish	100-Sow Feeder Pig Operation	Finish Feeder Pigs
Gross Receipts	$143,302	$63,917	$133,268
Operating Cost	77,256	30,231	108,140
Capital Cost[B/]	9,409	5,770	6,601
Ownership Cost	10,261	7,307	3,900
Labor Cost[C/]	7,204	5,043	3,528
Returns to Land, Overhead, Risk and Management	39,172	15,566	11,098

[A/] Feed is purchased off the farms.

[B/] 10 percent interest rate.

[C/] $3.00 per hour wage rate.

The initial machinery and building investment for this confinement system is around $83,000 if the owner acts as the general contractor, but $100,000 to $150,000 if it is turn-key constructed. Operating inputs, including labor, total over $84,000 annually, with well over $60,000 dollars of this being feed cost ($4 milo and $8 soybean meal). Ownership and capital costs that total close to $20,000 annually result in average annual returns to land, overhead, risk and management of $39,172.

It is found that a hog entrepreneur that elects to farrow and finish slaughter hogs is going to need either good credit to finance such an operation or have access to a large amount of capital. If this system is completely financed by borrowed capital, it will require at lease 3 1/2 years to repay a demand note loan, with the likelihood of substaining a maximum loan of over $125,000, and the possibility of management ability and economic conditions extending repayment time to 4 or 4 1/2 years. Net present value of returns of over $150,000 to the initial investment in long term items, such as building and equipment obviously means that this is a good investment if the operator already controls enough equity to establish the enterprise.

With regard to vertically integrating on-farm feed processing and on-farm grain storage, a comparison of average annual returns suggests that the per unit cost of production does not increase much when feed processing is added to the system. In fact, a comparison of average returns at various capital costs indicates that at interest rates lower then 10 percent the profitability of the farrow-to-finish system increases as feed processing and grain storage are added.

In conclusion, the evidence indicates that a 100-sow farrow-to-

finish confinement operation is potentially a very profitable enterprise. This conclusion is based on the assumed input-output relationship and an entreprenuer with above average management ability.

Feeder Pig Production

One of the basic results of analyzing the 100-sow feeder pig producing system is the major role the pricing formula, for the sale of the fifty pound feeder pigs, plays on the profitability of the enterprise. With a system such as this, that has an initial investment cost of approximately $60,000 and requires annually over $35,000 worth of operating inputs, it is necessary that the feeder pig pricing formula is one that yields returns that justify the level of management ability required as compared to the level of management required by the finishing operation that purchases the feeder.

With the price formula of 1.6 times the market hog price for the first forty pounds of feeder pig and market price for remaining pounds, it is found that this feeder pig operation that sells annually 1,435 feeders has returns to land, overhead, risk and management of $10,954. Whereas, the finishing operation that has lower fixed and labor costs has returns of over $16,000 annually. Assuming $40 market hogs, for the two operations to receive returns to labor, overhead, risk and management in proportion to the amount of labor used, the analysis indicates that the 1.6 factor should be 1.8. This formula results in returns to the feeder pig operation and the finishing operation of $15,566 and $11,098 respectively.

Based on the new feeder pig pricing formula, the cash flow analysis indicates that the 100-sow feeder pig system generates enough cash in-

come to pay back the initial investment cost in 4 1/2 years, with a maximum loan incurred of over $85,000. The effect of a reduction in pigs per litter to seven or a 25 percent increase in feed price is to extend the time needed to repay a demand note financial plan to over 6 years and to increase the maximum loan by about $4,000. If the entrepreneur already owns enough capital to establish the system, its ability to generate returns to investment of $55,502 in present value dollars makes it a feasible investment alternative.

The entire analysis, though, indicates that the integration of on-farm feed processing and grain storage is not an optimum combination of resources, since it reduces returns to land, overhead, risk and management by $2,505 when total interest cost is lowest. The present value analysis further substantiates this in that the discounted net present value of returns to investment for the feed processing system is $35,779 as compared to the system that purchases feed with net present value of returns to investment of $55,502.

Even though the evidence indicates that a feeder pig production operation is profitable, it must be stated that its profitability is contingent on two important factors, the price received for the feeder pig and the management ability of the operator.

Finish Feeder Pigs

The initial investment in buildings and equipment of a feeder pig finishing operation that sells an average of more than 1,500 slaughter hogs annually is estimated to be $32,900. Annual operating inputs, including labor, used yearly are valued at over $110,000, resulting in average returns to land, overhead, risk and management of $11,098

annually. This assumes market hogs are sold at $40 per hundred-weight and feeder pigs purchased at $32.80 per head.

The price received for the slaughter hogs (and paid for feeder pigs) and the price paid for feed have an important affect on the profit earned by the system. Assuming that the operation is 100 percent financed and slaughter hogs sell at $40 per hundred-weight means that five years are required to repay the debt of the entrepreneur. With $38 market hogs seven years are required to repay the debt. If the price of milo and soybean meal averages $5 and $8 per hundred-weight respectively, the operator is not able to finance the entire operation, but must already own at least a portion of the operating or investment capital needed to start the enterprise. Ownership of the investment capital makes this a viable investment since the net discounted present value of returns to investment is over $33,000.

The coordination of on-farm feed processing and on-farm grain storage adds nothing to the profitability of the enterprise. In fact, a comparison of the returns earned by the various resource combinations indicates a per unit production cost increase as the stages of production are integrated.

In conclusion, it must be pointed out that the operating inputs make up a larger part of costs than the investment inputs; thus, the profitability of this enterprise is basically a function of the prices paid for the feed and the feeder pigs purchased for the system. This is partially offset by the fact that only 1/2 a man-year is required for labor leaving the owner-operator with labor for use in another income earning alternative.

Comparison of the Three Systems

The decision about which system is best for the hog farmer is a function of the amount of capital and labor he can supply. If a large amount of capital is available, either owned or financed, and enough labor is supplied, the 100-sow farrow-to-finish operation should be considered first. It is most favorable because it returns the most to management of the three systems, it has the shortest repayment time required, and is not as drastically affected by economic conditions, such as operating input and output prices, as the other systems.

The finishing operation is attractive when labor and/or investment capital is restricted, but is adversely affected by fluctuations in economic factors, particularly the hog-feed price relationship. The feeder pig operation shows higher returns to management than the finishing system, with a proper feeder pig price. For this reason, a feeder pig operation should probably only be considered when a contractual type agreement is made that results in a feeder pig price that yields equitable returns to the buyer and seller of the feeder pig.

Areas for Further Study

This study indicates that a confinement hog enterprise in Oklahoma is a profitable investment; but during the course of this study, it was necessary to make certain assumptions concerning the input-output relationship. Further hog studies, possibly based on record or survey data, should examine more closely such things as actual average litter size, feed conversion rates, and labor requirements. Another closely related area is the effect actual fluctuations in the price hog farmers pay and receive have on the net returns of hog farms in Oklahoma.

Another obvious area that requires research is alternative production processes. In particular semi-confinement type operations, that require less capital investment and operating investment, should be examined as alternative enterprises for the Oklahoma farmer.

Another question raised by this study is the importance the feeder pig pricing formula has on the feeder pig producer and finisher. The formula established in this study provides a means of establishing new feeder pig prices when the prices of feed and slaughter hogs change. Thus, additional work is needed to review and revise the feeder pig price as feed and slaughter hog prices change.

An area of extreme importance is the evaluation of alternative waste handling methods. Several methods exist that require differing amounts of labor and capital and have different effects on the enterprise.

Last, but not necessarily the least area, is the influence different financial arrangements have on the size of the operation and the profit of the enterprise.

A SELECTED BIBLIOGRAPHY

Bache, David H. "Costs and Returns in Hog Production - Detailed Budgets for the Swine Enterprise." (Paper presented at Annual Extension Workers Conference, Purdue University, Lafayette, Indiana, October, 1971).

Baumol, William J. Economic Theory and Operations Analysis. 3rd ed. Englewood Cliffs: Prentice - Hall Inc., 1972.

Blaich, Oswald P. "Integration in Theory with an Application to Hogs." Journal of Farm Economics, Volume XLII, No. 5 (December, 1960), pp. 142-149.

Blaich, Oswald P. Vertical Integration in Theory. Report No. 520. St. Paul: University of Minnesota, November, 1961.

Bloome, Peter D. and A. R. Tubbs. On-Farm Feed Processing: Systems, Economics, Financing. Circular E-816. Stillwater: Oklahoma State University, September, 1972.

Bloome, Peter D., R. W. Gose, S. Harp, and W. G. Luce. 100-Sow, Farrow-to-Finish Swine System. OSU Extension Facts, No. 1208. Stillwater: Oklahoma State University, September, 1974.

Bressler, R. G. "Research Determination of Economies of Scale." Journal of Farm Economics, Volume XXVII, No. 3 (August, 1945), pp. 526-539.

Heady, Earl O. and John L. Dillion. Agricultural Production Functions. Ames: The Iowa State University Press, 1972.

Leftwich, Richard H. The Price System and Resource Allocation. 3rd ed. New York: Holt, Rinehart, Winston, 1966.

Lines, A. E. and D. H. Bache. Planning Data for Hog Farms. Publication EC-408. Lafayette: Purdue University, January, 1972.

Madden, J. P. Economies of Size in Farming. A.E.R. No. 107. Washington, D.C.: Economic Research Service, United States Department of Agriculture, February, 1967.

Mighell, Ronald L. and L. A. Jone. Vertical Coordination in Agriculture. A.E.R. No. 19. Washington, D.C.: Economic Research Service, United States Department of Agriculture, February, 1963.

Oklahoma 1973 Agricultural Statistics. Oklahoma Crop and Livestock Reporting Service. Oklahoma City: Oklahoma Department of Agriculture, September, 1974.

Owens, T. R., J. Custer Snodgrass, and Hony Y. Lee. Labor Utilization Confinement Rearing of Swine Texas High Plains. ICASALS. Special Report No. 45. Lubbock: Texas Tech University, March, 1971.

Steven, Vernon and W. G. Luce. Swine Nutrition. Stillwater: Oklahoma State University, March, 1972.

Stigler, George J. The Theory of Price. New York: Macmillan and Company, 1946.

Trede, Larry D. Costs and Returns of Different Swine Production Systems. Publication EC-673. Ames: Iowa State University, August, 1971.

Tubbs, Alan R. and K. N. Wegenhoft. Cash Flow Planning: How? Stillwater: Oklahoma State University, August, 1971.

Tubbs, Alan R. and K. N. Wegenhoft. Cash Flow Planning: Why? Stillwater: Oklahoma State University, November, 1973.

Van Arsdall, Roy N. and W. A. Elder. Economies of Size Cash-Grain and Hog Farms. Bulletin 733. Urbana: University of Illinois, February, 1969.

Viner, Jacob. "Cost Curves and Supply Curves." Readings in Price Theory. Ed. G. J. Stigler and K. E. Boulding. Chicago: Richard D. Irwin, Inc., 1952, pp. 201-202.

Walker, Rodney L. and Darrel D. Kletke. The Application and Use of the Oklahoma State Crop and Livestock Budget Generator. Research Report P-663. Stillwater: Oklahoma State University, July, 1972.

APPENDIXES

TABLE XXIV

AVERAGE ANNUAL COSTS AND RETURNS FOR THE 100-SOW FARROW-TO-FINISH SWINE SYSTEM THAT PROCESSES FEED

PRODUCTION	UNITS	QUANITY	WEIGHT	PRICE	VALUE/UNIT	VALUE
SLAUGHTER HOGS	HD.	103.00	2.20	40.520	89.14	9181.82
SLAUGHTER HOGS	HD.	207.00	2.20	44.720	98.38	20365.47
SLAUGHTER HOGS	HD.	237.00	2.20	37.880	83.34	19750.62
SLAUGHTER HOGS	HD.	237.00	2.20	41.320	90.90	21544.23
SLAUGHTER HOGS	HD.	237.00	2.20	41.160	90.55	21460.81
SLAUGHTER HOGS	HD.	207.00	2.20	37.320	82.10	16995.52
SLAUGHTER HOGS	HD.	207.00	2.20	37.920	83.42	17268.76
SOWS	HD.	19.00	3.00	37.000	111.00	2109.00
SOWS	HD.	105.00	3.70	36.000	133.20	13985.99
BOAR	HD.	5.00	4.00	32.000	128.00	640.00
TOTAL RECEIPTS						143302.06

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PRICE	VALUE
MILO	CWT.	3146.00	1.01	3177.458	3.99	12678.05
MILO	CWT.	3247.00	1.01	3279.468	4.03	13216.25
MILO	CWT.	3257.00	1.01	3289.568	3.93	12928.00
SOYBEAN MEAL	CWT.	394.00	1.00	394.000	7.89	3108.66
SOYBEAN MEAL	CWT.	408.00	1.00	408.000	7.92	3231.36
SOYBEAN MEAL	CWT.	411.00	1.00	411.000	7.88	3238.68
SOYBEAN MEAL	CWT.	412.00	1.00	412.000	8.10	3337.20
SOYBEAN MEAL	CWT.	411.00	1.00	411.000	8.21	3374.31
SOYBEAN MEAL	CWT.	412.00	1.00	412.000	8.00	3296.00
SALT	CWT.	64.80	1.00	64.800	2.10	136.08
DICAL PHOSPHATE	CWT.	195.00	1.00	195.000	3.10	604.50
CALCIUM	CWT.	96.00	1.00	96.000	.80	172.80
CORN	BU.	360.00	1.00	360.000	2.50	900.00
SUCROSE	CWT.	15.60	1.00	15.600	10.00	156.00
DRIED WHEY	CWT.	31.20	1.00	31.200	9.00	280.80
VIT TRACE	CWT.	12.00	1.00	12.000	50.00	600.00
ALF MEAL	CWT.	150.00	1.00	150.000	4.50	675.00
VET & MED.	HD.	1764.00	1.00	1764.000	1.50	2646.00
SELL & HAULING	HD.	1559.00	1.00	1559.000	1.50	2338.50
BOAR PIGS	HD.	5.00	1.00	5.000	300.00	1500.00
UTILITIES	DOL.	12.00	1.00	12.000	114.36	1372.32
OPER. TAX & INS.	DOL.	41759.00	1.00	41759.000	0.02	785.07
TRACTOR FUEL COST						19.17
TRACTOR REPAIR COST						50.81
TRACTOR LUBE COST						2.87
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						36.92
EQUIPMENT REPAIR						2465.00
TOTAL OPERATING COST						73340.19
RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT						69961.88

CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	33151.125	3315.11
TRACTOR INVESTMENT	0.100	304.454	30.45
MACHINERY INVESTMENT	0.100	1214.760	121.48
EQUIPMENT INVESTMENT	0.100	56749.863	5674.98
LIVESTOCK INVESTMENT	0.100	11499.996	1150.00
TOTAL INTEREST CHARGE			10292.01
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT			59669.86

OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)		
TRACTOR	DOL.	40.97
MACHINERY	DOL.	247.38
EQUIPMENT	DOL.	12439.48
LIVESTOCK	DOL.	216.20
TOTAL OWNERSHIP COST		12944.03
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT		46725.84

LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	361.199	1083.60
LIVESTOCK LABOR	3.000	2160.000	6480.00
TOTAL LABOR COST			7563.59
RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT			39162.24

TABLE XXV

AVERAGE ANNUAL COSTS AND RETURNS FOR THE 100-SOW FARROW-TO-FINISH SWINE SYSTEM THAT PROCESSES FEED AND STORES ONE YEAR'S GRAIN REQUIREMENT

PRODUCTION	UNITS	QUANITY	WEIGHT	PRICE	VALUE/UNIT	VALUE
SLAUGHTER HOGS	HD.	103.00	2.20	40.520	89.14	9181.82
SLAUGHTER HOGS	HD.	207.00	2.20	44.720	98.38	20365.47
SLAUGHTER HOGS	HD.	237.00	2.20	37.880	83.34	19750.62
SLAUGHTER HOGS	HD.	237.00	2.20	41.320	90.90	21544.23
SLAUGHTER HOGS	HD.	237.00	2.20	41.160	90.55	21460.81
SLAUGHTER HOGS	HD.	207.00	2.20	37.320	82.10	16995.52
SLAUGHTER HOGS	HD.	207.00	2.20	37.920	83.42	17268.76
SOWS	HD.	19.00	3.00	37.000	111.00	2109.00
SOWS	HD.	105.00	3.70	36.000	133.20	13985.99
BOAR	HD.	5.00	4.00	32.000	128.00	640.00
TOTAL RECEIPTS						143302.06

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PRICE	VALUE
MILO	CWT.	9650.00	1.02	9842.992	3.82	37600.23
SOYBEAN MEAL	CWT.	394.00	1.00	394.000	7.89	3108.66
SOYBEAN MEAL	CWT.	408.00	1.00	408.000	7.92	3231.36
SOYBEAN MEAL	CWT.	411.00	1.00	411.000	7.88	3238.68
SOYBEAN MEAL	CWT.	412.00	1.00	412.000	8.10	3337.20
SOYBEAN MEAL	CWT.	411.00	1.00	411.000	8.21	3374.31
SOYBEAN MEAL	CWT.	412.00	1.00	412.000	8.00	3296.00
SALT	CWT.	64.80	1.00	64.800	2.10	136.08
DICAL PHOSPHATE	CWT.	195.00	1.00	195.000	3.10	604.50
CALCIUM	CWT.	96.00	1.00	96.000	1.80	172.80
CORN	BU.	360.00	1.00	360.000	2.50	900.00
SUCROSE	CWT.	15.60	1.00	15.600	10.00	156.00
DRIED WHEY	CWT.	31.20	1.00	31.200	9.00	280.80
VIT TRACE	CWT.	12.00	1.00	12.000	50.00	600.00
ALF MEAL	CWT.	150.00	1.00	150.000	4.50	675.00
VET & MED.	HD.	1764.00	1.00	1764.000	1.50	2646.00
SELL & HAULING	HD.	1559.00	1.00	1559.000	1.50	2338.50
BOAR PIGS	HD.	5.00	1.00	5.000	300.00	1500.00
UTILITIES	DOL.	12.00	1.00	12.000	114.36	1372.32
OPER. TAX & INS.	DOL.	54220.00	1.00	54220.000	0.02	1019.34
TRACTOR FUEL COST						19.17
TRACTOR REPAIR COST						50.81
TRACTOR LUBE COST						2.87
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						36.92
EQUIPMENT REPAIR						2513.00
TOTAL OPERATING COST						72400.38

RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT	70901.69

CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	35590.668	3559.07
TRACTOR INVESTMENT	0.100	304.454	30.45
MACHINERY INVESTMENT	0.100	1214.760	121.48
EQUIPMENT INVESTMENT	0.100	60709.824	6070.98
LIVESTOCK INVESTMENT	0.100	11499.996	1150.00
TOTAL INTEREST CHARGE			10931.96

RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT	59969.73

OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)		
TRACTOR	DOL.	40.97
MACHINERY	DOL.	247.38
EQUIPMENT	DOL.	12966.52
LIVESTOCK	DOL.	216.20
TOTAL OWNERSHIP COST		13471.07

RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT	46498.66

LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	361.199	1083.60
LIVESTOCK LABOR	3.000	2160.000	6480.00
TOTAL LABOR COST			7563.59

RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT	38935.07

TABLE XXVI

AVERAGE ANNUAL COSTS AND RETURNS FOR THE 100-SOW FEEDER PIG PRODUCTION SYSTEM THAT PROCESSES FEED AND STORES ONE YEAR'S GRAIN REQUIREMENT

PRODUCTION	UNITS	QUANITY	WEIGHT	PRICE	VALUE/UNIT	VALUE
FEEDER PIGS	HD.	103.00	0.50	59.970	29.98	3088.45
FEEDER PIGS	HD.	207.00	0.50	66.180	33.09	6849.63
FEEDER PIGS	HD.	237.00	0.50	56.060	28.03	6643.11
FEEDER PIGS	HD.	237.00	0.50	61.150	30.57	7246.27
FEEDER PIGS	HD.	237.00	0.50	60.920	30.46	7219.02
FEEDER PIGS	HD.	207.00	0.50	55.230	27.61	5716.30
FEEDER PIGS	HD.	207.00	0.50	56.120	28.06	5808.42
SOWS	HD.	19.00	3.00	37.000	111.00	2109.00
SOWS	HD.	105.00	3.70	36.000	133.20	13985.99
BOAR	HD.	5.00	4.00	32.000	128.00	640.00
TOTAL RECEIPTS						59306.19

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PRICE	VALUE
MILO	CWT.	2772.00	1.02	2827.438	3.99	11281.48
SOYBEAN MEAL	CWT.	296.00	1.00	296.000	7.89	2335.44
SOYBEAN MEAL	CWT.	297.00	1.00	297.000	7.88	2340.36
SOYBEAN MEAL	CWT.	298.00	1.00	298.000	8.21	2446.58
SALT	CWT.	20.40	1.00	20.400	2.10	42.84
DICAL PHOSPHATE	CWT.	55.20	1.00	55.200	3.10	171.12
CALCIUM	CWT.	28.80	1.00	28.800	1.80	51.84
CORN	BU.	360.00	1.00	360.000	2.50	900.00
SUCROSE	CWT.	15.60	1.00	15.600	10.00	156.00
DRIED WHEY	CWT.	31.20	1.00	31.200	9.00	280.80
VIT TRACE	CWT.	6.00	1.00	6.000	50.00	300.00
ALF MEAL	CWT.	150.00	1.00	150.000	4.50	675.00
BOAR PIGS	HD.	5.00	1.00	5.000	300.00	1500.00
VET & MED.	HD.	1764.00	1.00	1764.000	1.30	2293.20
SELL & HAULING	HD.	1559.00	1.00	1559.000	0.75	1169.25
UTILITIES	DOL.	12.00	1.00	12.000	72.62	871.44
OPER. TAX & INS.	DOL.	17550.00	1.00	17550.000	0.02	329.94
TRACTOR FUEL COST						19.17
TRACTOR REPAIR COST						50.81
TRACTOR LUBE COST						2.87
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						36.92
EQUIPMENT REPAIR						1870.00
TOTAL OPERATING COST						29315.26
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT						29990.93

CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	15059.820	1505.98
TRACTOR INVESTMENT	0.100	304.454	30.45
MACHINERY INVESTMENT	0.100	1214.760	121.48
EQUIPMENT INVESTMENT	0.100	43412.434	4341.24
LIVESTOCK INVESTMENT	0.100	11499.996	1150.00
TOTAL INTEREST CHARGE			7149.14
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT			22841.79

OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)		
TRACTOR	DOL.	40.97
MACHINERY	DOL.	247.38
EQUIPMENT	DOL.	9408.14
LIVESTOCK	DOL.	216.20
TOTAL OWNERSHIP COST		9912.68
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT		12929.11

LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	361.199	1083.60
LIVESTOCK LABOR	3.000	1362.000	4086.00
TOTAL LABOR COST			5169.59
RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT			7759.52

TABLE XXVII

AVERAGE ANNUAL COSTS AND RETURNS FOR THE FINISHING FEEDER PIGS SWINE SYSTEM THAT PROCESSES FEED

PRODUCTION	UNITS	QUANITY	WEIGHT	PRIC	VALUE/UNIT	VALUE
SLAUGHTER HOGS	HD.	119.00	2.20	40.520	89.14	10608.12
SLAUGHTER HOGS	HD.	232.00	2.20	44.720	98.38	22825.07
SLAUGHTER HOGS	HD.	232.00	2.20	37.880	83.34	19333.94
SLAUGHTER HOGS	HD.	232.00	2.20	41.320	90.90	21089.71
SLAUGHTER HOGS	HD.	232.00	2.20	41.160	90.55	21008.05
SLAUGHTER HOGS	HD.	232.00	2.20	37.320	82.10	19048.11
SLAUGHTER HOGS	HD.	232.00	2.20	37.920	83.42	19354.36
TOTAL RECEIPTS						133267.19

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PRICE	VALUE
MILO	CWT.	2559.00	1.01	2584.588	3.99	10312.[illegible]
MILO	CWT.	2676.00	1.01	2702.758	4.03	10892.1[illegible]
MILO	CWT.	2702.00	1.01	2729.018	3.93	10725.0[illegible]
SOYBEAN MEAL	CWT.	292.00	1.00	292.000	7.89	2303.[illegible]
SOYBEAN MEAL	CWT.	301.00	1.00	301.000	7.92	2383.92
SOYBEAN MEAL	CWT.	313.00	1.00	313.000	7.88	2466.44
SOYBEAN MEAL	CWT.	301.00	1.00	301.000	8.10	2438.10
SOYBEAN MEAL	CWT.	324.00	1.00	324.000	.21	2660.04
SOYBEAN MEAL	CWT.	304.00	1.00	304.000	8.00	2432.00
SALT	CWT.	48.00	1.00	48.000	2.10	100.80
DICAL PHOSPHATE	CWT.	144.00	1.00	144.000	3.10	446.40
CALCIUM	CWT.	72.00	1.00	72.000	1.80	129.60
VIT TRACE	CWT.	6.00	1.00	6.000	50.00	300.00
FEEDER PIGS	CWT.	0.50	120.00	60.000	59.97	3598.20
FEEDER PIGS	CWT.	0.50	240.00	120.000	66.18	7941.60
FEEDER PIGS	CWT.	0.50	240.00	120.000	56.06	6727.20
FEEDER PIGS	CWT.	0.50	240.00	120.000	61.15	7338.00
FEEDER PIGS	CWT.	0.50	240.00	120.000	60.92	7310.39
FEEDER PIGS	CWT.	0.50	240.00	120.000	55.23	6627.60
FEEDER PIGS	CWT.	0.50	240.00	120.000	56.12	6734.40
SELL & HAULING	HD.	1511.00	1.00	1511.000	1.50	2266.50
VET & MED.	HD.	1560.00	1.00	1560.000	1.00	1560.00
UTILITIES	DOL.	12.00	1.00	12.000	41.00	492.00
OPER. TAX & INS.	DOL.	42083.00	1.00	42083.000	0.02	791.16
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						32.42
EQUIPMENT REPAIR						957.50
TOTAL OPERATING COST						100157.63

RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT			33109.56
CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	42982.426	4298.24
MACHINERY INVESTMENT	0.100	729.275	72.93
EQUIPMENT INVESTMENT	0.100	29937.480	2993.75
TOTAL INTEREST CHARGE			7364.91
RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT			25744.65
OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)			
MACHINERY	DOL.		177.28
EQUIPMENT	DOL.		6328.50
TOTAL OWNERSHIP COST			6505.77
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT			19238.88
LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	216.000	648.00
LIVESTOCK LABOR	3.000	1056.000	3168.00
TOTAL LABOR COST			3816.00
RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT			15422.88

TABLE XXVIII

AVERAGE ANNUAL COSTS AND RETURNS FOR THE FINISHING FEEDER PIGS SWINE SYSTEM THAT PROCESSES FEED AND STORES ONE YEAR'S GRAIN REQUIREMENT

PRODUCTION	UNITS	QUANITY	WEIGHT	PRICE	VALUE/UNIT	VALUE
SLAUGHTER HOGS	HD.	119.00	2.20	40.520	89.14	10608.12
SLAUGHTER HOGS	HD.	232.00	2.20	44.720	98.38	22825.07
SLAUGHTER HOGS	HD.	232.00	2.20	37.880	83.34	19333.94
SLAUGHTER HOGS	HD.	232.00	2.20	41.320	90.90	21089.71
SLAUGHTER HOGS	HD.	232.00	2.20	41.160	90.55	21008.05
SLAUGHTER HOGS	HD.	232.00	2.20	37.320	82.10	19048.11
SLAUGHTER HOGS	HD.	232.00	2.20	37.920	83.42	19354.36
TOTAL RECEIPTS						133267.19

OPERATING INPUTS	UNITS	RATE PER UNIT	NUMBER OF UNITS	TOTAL UNITS	PRICE	VALUE
MILO	CWT.	7937.00	1.02	8095.734	3.82	30925.71
SOYBEAN MEAL	CWT.	292.00	1.00	292.000	7.89	2303.88
SOYBEAN MEAL	CWT.	301.00	1.00	301.000	7.92	2383.92
SOYBEAN MEAL	CWT.	313.00	1.00	313.000	7.88	2466.44
SOYBEAN MEAL	CWT.	301.00	1.00	301.000	8.10	2438.10
SOYBEAN MEAL	CWT.	324.00	1.00	324.000	8.21	2660.04
SOYBEAN MEAL	CWT.	304.00	1.00	304.000	8.00	2432.00
SALT	CWT.	48.00	1.00	48.000	2.10	100.80
DICAL PHOSPHATE	CWT.	144.00	1.00	144.000	3.10	446.40
CALCIUM	CWT.	72.00	1.00	72.000	1.80	129.60
VIT TRACE	CWT.	6.00	1.00	6.000	50.00	300.00
FEEDER PIGS	CWT.	0.50	120.00	60.000	59.97	3598.20
FEEDER PIGS	CWT.	0.50	240.00	120.000	66.18	7941.60
FEEDER PIGS	CWT.	0.50	240.00	120.000	56.06	6727.20
FEEDER PIGS	CWT.	0.50	240.00	120.000	61.15	7338.00
FEEDER PIGS	CWT.	0.50	240.00	120.000	60.9	7310.39
FEEDER PIGS	CWT.	0.50	240.00	120.000	55.23	6627.60
FEEDER PIGS	CWT.	0.50	240.00	120.000	56.12	6734.40
SELL & HAULING	HD.	1511.00	1.00	1511.000	1.50	2266.50
VET & MED.	HD.	1560.00	1.00	1560.000	1.00	1560.00
UTILITIES	DOL.	12.00	1.00	12.000	41.00	492.00
OPER. TAX & INS.	DOL.	52389.00	1.00	52389.000	0.02	984.91
MACHINERY FUEL COST						165.43
MACHINERY LUBE COST						24.82
MACHINERY REPAIR COST						32.42
EQUIPMENT REPAIR						993.50
TOTAL OPERATING COST						99383.50

RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT	33883.69

CAPITAL COST	PRICE	AMOUNT	VALUE
ANNUAL OPERATING CAPITAL	0.100	44724.449	4472.44
MACHINERY INVESTMENT	0.100	729.275	72.93
EQUIPMENT INVESTMENT	0.100	32907.480	3290.75
TOTAL INTEREST CHARGE			7836.11

RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT	26047.57

OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)		
MACHINERY	DOL.	177.28
EQUIPMENT	DOL.	6723.77
TOTAL OWNERSHIP COST		6901.05

RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT	19146.52

LABOR COSTS	PRICE	HOURS	
MACHINERY LABOR	3.000	216.000	648.00
LIVESTOCK LABOR	3.000	1056.000	3168.00
TOTAL LABOR COST			3816.00

RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT	15330.52

VITA

Richard Niles Weldon

Candidate for the Degree of

Master of Science

Thesis: AN ECONOMIC EVALUATION OF CONFINEMENT SWINE SYSTEMS IN OKLAHOMA

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Conneaut, Ohio, March 20, 1949, the son of Mr. and Mrs. Paul A. Weldon.

Education: Graduated from Northwestern Area High School, Albion, Pennsylvania, May, 1967; received Bachelor of Science degree in Agricultural Business and Management from Pennsylvania State University, University Park, Pennsylvania, June, 1973; completed requirements for the Master of Science degree in July, 1975, at Oklahoma State University, Stillwater, Oklahoma.

Professional Experience: Agricultural Economics Intern with Valley Rural Electric Cooperative, Huntingdon, Pennsylvania, 1972; Research Assistant, Oklahoma State University, Stillwater, Oklahoma, from August, 1973 to September, 1974; Instructor, Oklahoma State University, Stillwater, Oklahoma, October, 1974 to December, 1974.